FOREST FIRE CONTROL IN SOUTHERN CALIFORNIA

UNIVERSITY
OF MICHIGAN

FEB

MAIN
READING ROOM

HEARINGS

BEFORE A

SPECIAL SUBCOMMITTEE

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-FIFTH CONGRESS

FIRST SESSION

ON

MATTERS RELATIVE TO THE CONTROL OF FOREST AND BRUSH FIRES IN SOUTHERN CALIFORNIA

LOS ANGELES, CALIF.
OCTOBER 8 AND 9, 1957

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FOREST FIRE CONTROL IN SOUTHERN CALIFORNIA

TUESDAY, OCTOBER 8, 1957

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE OF THE COMMITTEE
ON INTERIOR AND INSULAR AFFAIRS,
Los Angeles, Calif.

The subcommittee met, pursuant to notice, at 9:10 a. m., in room 518, the Federal Building, Hon. Clair Engle presiding.

The CHAIRMAN. The subcommittee will be in order.

This morning we commence the testimony regarding the problem of forest-fire prevention and control. I am glad to note this is Fire Prevention Week here, which seems to make this an appropriate atmosphere for the hearing.

The Chair desires to make a short statement.

During the past week, this committee has traveled over much of southern California. We have driven through the mountains, and we have flown over the top of them. We have been greatly impressed by the sheer ruggedness of these mountains, and how civilization has crowded right up to the steep brush slopes. I am very much aware of the need for water in this southland and that nearly three-fourths of your present annual water requirements comes from these same mountain watersheds.

Flying back from Blythe last Saturday we saw the debris-laden washes of the Santa Ana, San Antonio, and San Gabriel Rivers. We were particularly impressed by the great flood-control dams you people have built to stop the onrush of muck and boulders from enveloping your homes, citrus groves, and vineyards.

In my judgment, the fire problem in southern California, based on what we have seen the past few days, is more critical than in any other section of the United States—probably on this earth, for that matter. Too many fires get started, too many get out of control, too many vital watersheds are blackened and ruined. And, unfortunately, lives are sometimes lost in these holocausts.

These fires of this year have been about as numerous as in 1956, but thus far they have been smaller and less costly. In 1956 total damages within the limits of the four national forests were estimated at nearly $8 million. Losses in adjoining areas were even more. By midfire season of this year, southern California national forest losses have totaled no more than $150,000. The losses of 1956 averaged in the neighborhood of $100 an acre; during the first half of the 1957 fire season they have been less than $15 an acre.

At this point I want to say that the Forest Service has an excellent record in fire-control methods. They have been progressive and even adventurous in the field of new methods. They have a better system

of smoke jumpers than you can probably find in the parachute division of our Army. They have been using aerial tankers to spray these fires, with a good deal of success. So I say they have shown initiative and they have been extremely progressive, almost to the point of being adventurous in the field of fire fighting.

Many people claim the prevention of all fire in the woods and chaparral builds up dangerous accumulations of brush and litter. Periods of long drought accompanied by high winds and low humidity occur so often in this region that they believe fire is inevitable. They believe that frequent small fires would be less dangerous than a few big ones. Almost to a man, they recommend some form of controlled burning to follow the first fall rains.

Many who wrote were equally vigorous in support of the present nonfire program of the Forest Service. They claim any fire ruins the soil's ability to conserve water, and declare that a permanent cover of trees, brush, and grass is necessary to protect against erosion. A large year-round staff to protect against fire and to carry on other necessary work on the national forests is their answer to the problem, and this can best be accomplished with larger regular appropriations to the Forest Service.

All who ask to be heard have been advised of this hearing. Invitations to send representatives have also been extended to the United States Forest Service, the California Department of Natural Resources, the Los Angeles County Fire Department, other State and local agencies, and to interested citizen associations.

Some people might wonder why the Los Angeles County Fire Department is in this picture, but those familiar with the situation know that they have a job of fighting brush fires and fires out in the country areas just as well as in some metropolitan area.

I have called this hearing to learn why southern California is plagued by so many fires and why many of them get to be so large. While coming in we noticed vast areas which have been burned over to the east of Los Angeles. One fire, I understand, took a million dollars to control.

I want to be able to assure the people in this area that every possible means is being used to keep forest and brush fires from starting and destroying so much of your valuable local watersheds. Of course, people have moved right out into these forest areas, and when these forest fires start not only the forest resources but the homes and even communities are menaced.

We have a long list of witnesses, and, in order to get them all heard in the few days, it will be necessary to ask the witnesses to file and to summarize their statements.

The Chair is going to suggest that each of these witnesses be prepared to proceed on the opening statement with a summary of not more than 10 minutes, and then we will try to question some of these witnesses or groups of witnesses en bloc.

The first witnesses will be from the Forest Service, the California Division of Forestry, the California Department of Natural Resources, and the Los Angeles County Fire Department.

Without objection, we will hear those witnesses, plus Col. H. E. Hedger, Chief Engineer of the Los Angeles County Flood Control District, if that is agreeable to the committee, on their summary statement. And then we will address questions to the group because they

represent every strata of local and State and Federal Government in this picture. If there is no objection, that will be the order of the committee.

Hearing no objection, we will proceed in that manner.

The first witness is Regional Forester Charles A. Connaughton, California District, United States Forest Service.

Mr. Connaughton, we are glad to have you with us. Would it be possible for you to summarize your statement? We will be glad to have your entire statement appear in the record. Can you summarize it in 10 minutes?

STATEMENT OF CHARLES A. CONNAUGHTON, REGIONAL FORESTER, CALIFORNIA REGION, UNITED STATES FOREST SERVICE, SAN FRANCISCO, CALIF.

Mr. CONNAUGHTON. I will be glad to, Mr. Chairman. I left copies of my statement for the record, and this will be a very brief summary of it.

In this general statement is a picture putting the southern California fire problem in perspective nationally, and, inasmuch as we are local and considering this from a local set of circumstances, I will pass that over. However, to get a grasp of the fire picture here in southern California, let's just take a moment to take a look at the situation topographically and geographically as it prevails.

We have here in the valleys a very highly developed urban-rural economy, and the background for it, of course, is the screen of mountains to the east. It is an arid region in which precipitation is exceedingly limited and very seasonal. With the mountains in the back, they serve as a screen to force the clouds high, causing precipitation which, in turn, is discharged to the valleys below, and, using that water, civilization such as we have here has been developed.

This means, of course, that the mountains and valleys are intricately interrelated; one without the other would be rather meaningless. To be sure, water could be imported for long distances, and some of it is. But, still, the local water, the water that comes from the local watersheds, is the most usable and the most valuable water available to this community.

About half of this water comes from the national forests or from watersheds within the national forests. These mountains, although extremely valuable in character and absolutely essential to the maintenance of the civilization which we have here, can also be very treacherous and sinister if not properly used.

As an occasion in point, observations through the years on a series of experimental watersheds have shown that flood peaks are tripled in major storms if a watershed is completely burned over, and they may be increased 10 to 20 times on smaller storms from minor watersheds.

Debris, however, may increase as much as 30 times. In other words, the erosion rate jumps up tremendously if the watershed is burned or otherwise abused, the natural cover is destroyed or diminished improperly.

These watershed relationships—the mountain-valley water relationships—were recognized many years ago when the people of southern

California urged the Congress to establish national forest reserves and to protect them for watershed values. The second national forest established in the present-day system was known at that time as San Gabriel Forest Reserve, in 1892, embracing most of the watershed area behind Los Angeles.

The Forest Service was created to administer these reserves. So we recognize our obligation for watershed protection, which in many respects means fire protection here in southern California.

As the chairman has indicated, this fire problem in southern California watersheds is probably the most difficult, and at the same time the damages sustained can be more exaggerated than anywhere else in the entire country.

Not only is this an extremely important problem locally, but, in view of the dependent population and the industries and their nationwide significance, watershed protection in this locality has, in fact, a national significance.

There has been, as I indicated earlier, full realization of the significance of watershed protection through the years. However, in recent years it has grown more aggravated, far more serious, for several reasons.

First of all, we are having very severe fire weather. We have had continued drought, relatively speaking, in southern California since 1945. This has resulted in increased inflammability, in rapid spread of the fires once they start.

For example, measurement in 1956 indicates that there was a greater potential that year for more and larger fires than for any year in the last 15.

Furthermore, fires always could and still can occur any month in the season here in this locality.

Mr. SAYLOR. Mr. Connaughton, did you say any month of the season or any month of the year?

Mr. CONNAUGHTON. I mean any month of the year. Any season or any month of the year.

Another factor which has increased the seriousness and severity of it in recent years is the increased use of the mountain areas for recreational purposes, and, of course, there is the additional complication imposed upon the organization of the increased cost of doing business.

In this locality the Forest Service has responsibility for the protection of about 2 9/10 million acres of land. This is about 47 percent of the total watershed area. The remainder is protected by the State and county, and, to a lesser degree, by the fire districts and the military.

Somewhat as an aside but tying directly into that, there is a very intimate and close cooperation between these various protection agencies that in many respects could serve as a model throughout the rest of the country. It is extremely effective and has proven that it can do the job under times of stress.

Insofar as the national forest is concerned, in the period 1951–56 there were 1,505 fires on the national forests of southern California: 98 percent of these were less than 1,000 acres in size; 1½ percent were from 1,000 to 10,000 acres; and 10 of these fires, less than 1 percent exceeded 10,000 acres in size.

We feel this is a good record, but we certainly are not satisfied with it. It must be improved, and we know it.

There are several approaches, we think, to that improvement.

One approach that is frequently discussed and has been mentioned briefly in the opening statement of the chairman is the matter of fuel modification or hazard reduction through various means, including the controlled use of fire. This offers a wide range of opinion, and there are many points of view regarding it.

At this point I think I should distinguish between northern California and southern California, because there is quite a different brush problem, and, when you discuss it statewide, complexities arise that are not readily apparent on the surface.

Incidentally, I have a map here that indicates the extent of the brush area, and I will put it up here so you may look at it in case there is further interest.

You will observe the red areas, the common brush hardwood type of the foothills, and the green known as the chaparral type, which is so characteristic to southern California.

There is an overlay on the map which indicates the locations of the national forests in relation to these brush areas.

You will observe the bulk of the brush areas are not in the national forests in northern California, but there is a very significant portion within the national forests in southern California. Statewide, 22 percent of the brushlands of California are within the national forests.

Now in southern California, in relation to these brush types, we well recognize, on the part of the public protection agencies, that watershed values transcend all other values; and the necessity for maintaining a cover which will assure the best possible natural set of circumstances in terms of watershed values is what we are driving at.

Furthermore, these brushlands are permanent brush types. It is not land that once supported trees or grass in the main. History shows the chaparral in southern California was here when the white man came. So we have a natural set of circumstances with which we deal.

We do not feel, of course, that there is any place in the picture for taking the position that you cannot improve upon nature, and it has been done upon occasion. Yet we know that when you face it you are dealing with an extremely complex and difficult situation.

We have, however, considered and tested the opportunities of converting some of the brushlands into other less inflammable types, and studies have shown there are a few promising plants that might be substituted for some of the brushlands which would be less inflammable. We haven't gotten too much information on these plants, but there are some that show promise.

The proposal to stripburn or lightburn in certain areas is often discussed as a possibility of reducing hazards, and it does offer some possiblity in certain cases. However, it requires thorough preparation, it requires considerable cost, it requires a particular set of circumstances under which your burn may or may not be made. And certainly it requires immediate reestablishment of vegetation once the original cover may be removed. This, however, involves a proj-

ect, a study which must be continued and intensified, and we are proceeding in that direction.

Northern California poses quite a different problem. There in many cases, just as an aside, the brush types are not permanent. They were once timber or grass, and they have been, for one reason or another, converted to brush.

The brush-covered slopes of northern California are not as steep, the watersheds not as dramatic, and it does offer more opportunity for conversion. In fact, in the national forests there are now some 33 projects in which we are engaged in conversion of brush to other types, involving some 42,000 acres scattered throughout the State. I have a map showing those locations if members of the committee may like to examine it.

However, to brief this down very quickly, I would just like to read the Forest Service policy in respect to brush conversion and brush modification. It is simply stated as follows:

On steep slopes with highly erodible soils, particularly where brush is the climax type, as is the usual case in southern California, broadcast burning should not be used to reduce fire hazard. Fire can be used in a limited way under careful control to prepare fire lanes. The Forest Service believes that improved fire control is the best policy under those conditions. Experience tells us that the danger of floods, accelerated erosion, mud and rock flows, is too great if the protective brush and other cover is removed. This hazard is accentuated in southern California by the concentrations of people and high property values immediately at the base of the mountains. There is no known practical way to establish and maintain a permanent grass cover on such areas.

Even on areas with gentler slopes and more stable soils, which are found mainly in northern California, the Forest Service does not favor indiscriminate burning. We oppose indiscriminate burning because it will not be successful in a great many areas; it will result in waste of money, and it will often be followed by accelerated erosion and runoff.

On areas of gentler slopes and more stable soils, the Forest Service favors alteration or elimination of the brush cover by fire or other means under controlled conditions. The Forest Service is carrying out such a program on selected areas under its administration. Eventually, we feel that with improved knowledge and adequate funds and facilities, about one-half million acres of brushland in the national forests of California may be properly subjected to treatment.

To move along hastily to conclusion, I would like to indicate a few features of the job ahead.

The job ahead, first of all, involves setting up an objective to meet. That we have done; we have had it for sometime. Our objective is simply this:

No fire over 2,000 acres, and the annual burn in this locality not to exceed 5,600 acres total.

That is a high objective and one we have reached in only 1 year out of 31. However, we believe it is attainable.

There are certain things we must do in order to reach that goal. Some of these things, among others, are as follows:

We must continue to study new methods and techniques, including not only the control of fire but the prevention of fire and the various other aspects that go into organizing for fires prior to their occurrence, and in controlling them after they start.

We have made certain real systematic approaches to this, as, for example, an operation that was known as Fire Stop which was a systematic, organized effort in southern California in 1955 directed at bringing all cooperative agencies' knowledge to bear on how the problem could best be met.

We maintain an equipment development center in southern California directed toward this sort of thing. Furthermore, we are embarking on a more intensive program of the various aspects of fire prevention and control through the process of research in the Forest Experiment Station.

Air attack is a case in point that has been developed rather sharply in recent months, in which there are various types of drops from the air on burning fires, with the use of helicopters for transporting men and supplies and equipment. The fact of the matter is there is a broad horizon for the development of air attack in the application of fire-control techniques. This we should and must continue to develop.

We must continue to study much more intensively the opportunity for hazard reduction. What I mean by hazard reduction is fuel modification or brushstrip burning, or whatever you want to term it. That is the research aspect; the study aspect of that is being placed on a projectwide basis currently.

Numerous other things can be carried out. We need to expand what we term preplanning work. That is, preparing the area and understanding it in advance. Development of access, firebreaks, mapping of the area in relation to what types and kinds of equipment can be used, and the placing of helispots for helicopter use, are part of preplanning.

It is a constantly shifting thing because as new equipment becomes available, plans, too, must be adjusted to keep current with the new types and kinds of uses. It calls for additional water development and storage, more roads, helispots, fire breaks. Those are the things on the ground that we need to place the area in the best possible condition to meet fire when it comes.

Of course, we have the problem of manpower and organization. There is a need for additional manpower. Tenure of present employees should be lengthened from seasonal in many cases to a year-long basis.

Our training program we have always emphasized and will continue to emphasize, including the hazard-safety aspects. Any time a fire occurs it imposes real hazards to the men engaged in fighting it. Last year we had the tragic loss of 11 lives in the fire in Cleveland National Forest in southern California. This is a concrete, driving reminder that fire safety must dominate all else.

Incidentally, in relation to the fire in which the lives were lost, a thorough study has been made of the situation, and I have a copy of that here and would like to leave it for the record.

The CHAIRMAN. Is that the report on the fire where 11 people lost their lives?

Mr. CONNAUGHTON. Yes.

The CHAIRMAN. Without objection, that will be made a part of the record.

(The report follows:)

THE INAJA FOREST FIRE DISASTER, CLEVELAND NATIONAL FOREST, CALIF.

"Surely these men gave their lives in defense of this country, for without the strength of our forests, water, and other natural resources, this Nation would not be a leader in the free world today."—RICHARD E. MCARDLE, *Chief, Forest Service.*

Killed in action in line of duty

OVERHEAD PERSONNEL

Name and age	Fire position	Regular position
Anderson, Albert W., 45	Night sector boss	Forest Service employee, Shasta-Trinity National Forest, Redding, Calif.
Lingo, Carlton Ray, 19	Night crew boss	Forest Service employee, Cleveland National Forest, San Diego, Calif.
Maxwell, Forrest B., 30	do	Forest Service employee, Shasta-Trinity National Forest, Redding, Calif.
Wehrung, LeRoy, 41	Correctional officer	Mechanic, Viejas honor camp, San Diego County, Calif.

VIEJAS HONOR CAMP MEN

Daniels, Miles, 33	Fire fighter	Inmate.
Fallin, William D., 22	do	Do.
Garcia, George A., 41	do	Do.
Hamilton, Virgil L., 26	do	Do.
O'Hara, Joseph P., 45	do	Do.
Shepherd, Lonnie L., 26	do	Do.
Tibbitts, Joe, 34	do	Do.

THE INAJA FOREST FIRE DISASTER (PRONOUNCED INN-AH-HAH) NOVEMBER 25, 1956, CLEVELAND NATIONAL FOREST, CALIFORNIA REGION

Eleven men lost their lives in a fire blowup in San Diego Canyon in the Inaja fire, Cleveland National Forest, at 8:05 p. m., Sunday, November 25, 1956. Those killed included 3 Forest Service employees, a correctional officer, and 7 inmates of San Diego County's Viejas honor camp. One Forest Service employee and 6 inmates escaped uninjured.

The Office of the Chief, Forest Service, United States Department of Agriculture, was notified at 3 a. m. (midnight, Pacific Coast time), as soon as the Cleveland National Forest and California region had positively determined the general facts of the disaster.

Preliminary investigation

Chief Richard E. McArdle immediately dispatched to the scene of the tragedy Merle S. Lowden, chief of the division of fire control, and safety officer Seth Jackson, both of the Washington office, to gather pertinent detailed facts for the Chief's office. They spent November 27 through December 3 with Forest Service Regional Fire Chief M. M. Nelson and other regional, forest, and Inaja fire personnel studying the disaster area, interviewing and getting statements from those directly connected with the fire action or who might have pertinent information.

Investigative team

Concurrent with sending the chief fire control officer and safety officer to the scene of the fire, the Chief of the Forest Service selected a top-level investigative team to go to the fire area. The team was headed by Assistant Chief of the Forest Service W. S. Swingler of Washington, D. C., and included Donald E. Clark, regional forester at Denver, Colo.; Lawrence K. Mays, assistant regional forester at Atlanta, Ga.; Jack S. Barrows, Intermountain Experiment Station fire research chief, Missoula, Mont.; and Mr. Lowden. Safety Officer Seth Jackson was designated as adviser.

In charging the investigative team with its responsibilities, Mr. McArdle said, "The scope of investigation should be directed to circumstances, events, and in-

stances which led to the tragic loss of 11 fire fighters * * * we want facts, what happened, how, and why. And we want these facts studied carefully and evaluated to formulate sound conclusions and recommendations—how could the final outcome, or any of the occurrences or situations leading up to it, have been avoided? Above all, include instances of carelessness or oversight that can be prevented in the future."

The investigative team assembled in San Diego, Calif., on December 3. It studied the accident scene on December 4, both from the air and on the ground. Interviews were arranged with the various officials, fire bosses, and fire fighters who were eyewitnesses to the disaster. These interviews, as in all previous investigations of disastrous fires, were originally scheduled in private in order to avoid unnecessary tension on the part of eyewitnesses. However, it became evident that the public interest in this particular fire disaster was so great that the interviews should be made public. Relatives and friends of the victims and the general public were invited to meet with the investigative team, and members of the press were present. Officials of both State and county agencies participated in the investigation. Upon completion of their investigation the team submitted their findings to the Chief of the Forest Service.

Origin of fire

The Inaja fire allegedly was set by a 16-year-old Indian, Gilbert Paipa, at his home on the Inaja Indian Reservation about 9:10 a. m., Saturday, November 24, 1956. He was apprehended by, and confessed to, Forest Service Investigator Elwood Stone, on Wednesday, November 28. Paipa said, "I just got a mad, crazy idea to do it. I threw a match in the grass to see if it would burn."

Initial control action

Two lookouts[1] reported the fire at 9:15 a. m. A three-man tanker crew arrived at 9:25. They could not control it. Acting Ranger John Davis recognized the fire's danger and dispatched additional men and equipment. By 5 p. m., the fire had crossed the San Diego River bed to the west, run over Mount Gower and down the west side of El Capitan Reservoir and onto El Cajon Mountain. It had then burned an estimated 25,000 acres. In a meeting attended by Forest Supervisor Walter Puhn and officials of the California Division of Forestry, it was agreed that the State would handle all the fire west of the San Diego River except a portion on the north side of the fire between the river and Sawday truck trail. This latter division was across the river from division IV, where the tragedy later occurred.

On the second day of the fire, the Forest Service had four fire-fighting divisions led by experienced and qualified personnel from all parts of the California region. Pine Hills Guard Station was fire headquarters. The flanks of the fire had been contained except for three hot sectors—a handline from Eagle Peak down to the San Diego River on the south; across San Diego Canyon from rim to rim on the north; and across Cedar Creek at the rear of the fire. The latter was considered of greatest concern due to the threat to more than 100 homes nearby.

During the day, Sunday, the fire in San Diego River Canyon was advancing slowly up the canyon against the wind with occasional flareups. Tongues of flame intermittently moved ahead and up small side ridges. Fire on and just below the east rim of the canyon was quartering into the wind with occasional flareups as it reached heavy fuels.

High winds made it impossible to use helicopters until 4 p. m. The night line boss scouted division IV on the north side and east of the San Diego River at 4:30 p. m. (An aerial photomap of this area is shown on p. 3.) Because of the wind, he had to fly high. This situation, coupled with the smoke from the fire, made it impossible for him to get complete information as to control lines lost and progress of construction of other lines. The fire edge was relatively hot, burning into the wind on the west side and more slowly on the east side.

Burning conditions

Fire weather throughout southern California in 1956 was unusually severe. It was climaxed by a prolonged period of Santa Ana wind conditions[2] extend-

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[1] This and other technical terms in this report are explained in a glossary on the last page.

[2] Strong, dry winds from th desert area east of the coast mountains flowing down through the mountain passes and canyons to the sea.

ing from November 19 through the Inaja fire disaster on November 25. The area was having unprecedented drought. Rainfall had been well below normal for 4 years.

During the afternoon and evening of November 25, relative humidity in the vicinity of the fire was near 18 percent and temperature was about 68° F. Gusty east and northeast winds averaging 15 or 20 miles per hour, but with some gusts up to 40 miles, were observed at many places around the fire.

Brush consisting of chamise and sagebrush of medium density covered much of the disaster area. Moisture content of the brush approximated the lowest ever measured for these species, and is believed to be near the minimum possible.

The San Diego River bed was dry. The canyon walls are steep and rugged, with slopes as steep as 70 percent in many places. Rock outcroppings are common on both sides of the canyon. The distance from the rim to the riverbed was about 3,500 feet in the disaster area.

Day shift action, November 25

The job to be done on the east side of the San Diego River Canyon (division IV, sector G) was to clear by tractor a fire trail through the brush along the rim of the canyon and to construct by hand a similar trail from the top of the canyon rim to the dry riverbed on the canyon floor. These trails were to serve as control lines for burning back to the main fire.

The tractor-built trail running along the rim was completed by 11 a. m. Some burning out to make the trail wider was started. The trail was patrolled by a 4-man crew, using a 280-gallon water tanker. Two attempts were made to start hand construction of the trail from the top of the rim to the canyon floor. In both cases the men were called back when it became evident that the trail could not be completed before being flanked by the main fire. Later in the day a third line was started. By 2 p. m. the crew had cut about 600 feet of fire trail downward from the canyon rim. It was estimated that 3 more hours of work were needed to reach the bottom. At about 3 p. m. the division boss withdrew the men for the third time because fire conditions seemed to make work there unsafe. The crew had completed nearly 1,100 feet of trail. The crew continued to patrol the tractor-built trail along the top rim of the canyon. Between 4 : 30 p. m. and 7 p. m. the fire quieted down. No flareups were observed during this period.

Night shift action, November 25

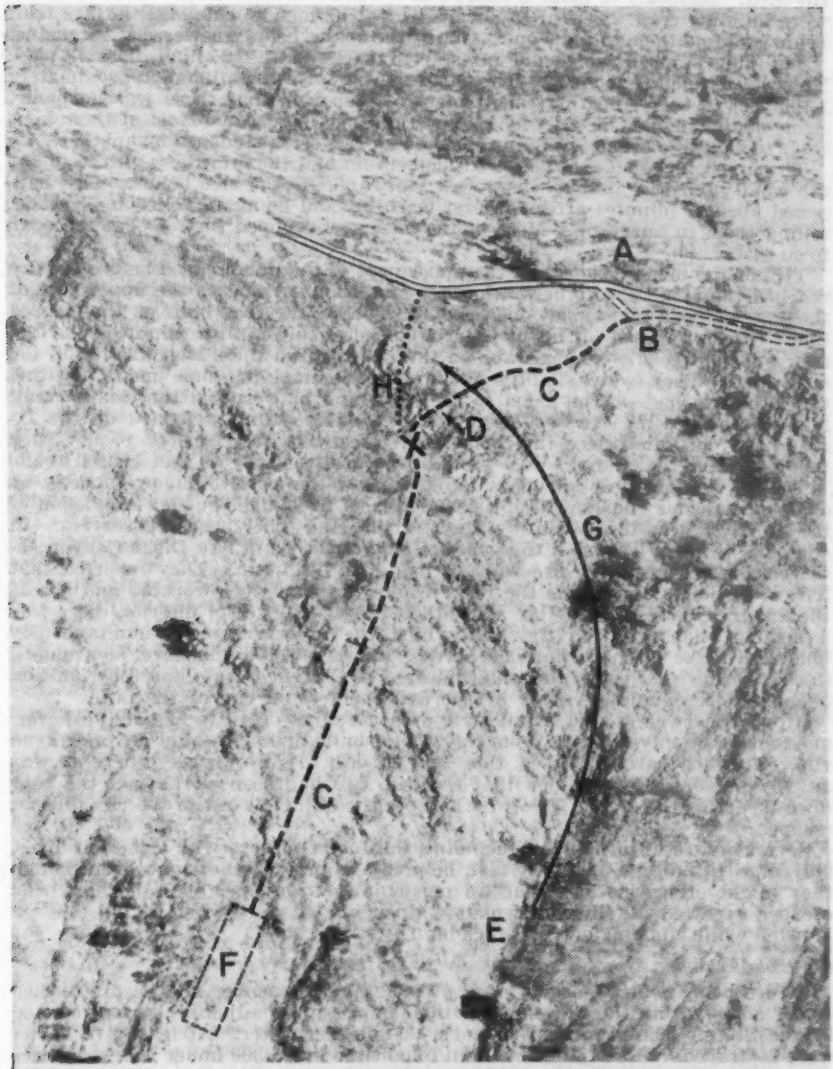
At the main camp the night shift division boss was instructed to build line and burn out. Since there was little specific information on sector G available at the main camp because of the partial ineffectiveness of aerial reconnaissance, he was told to check with the day division boss for conditions on the ground.

The night shift arrived at the fire after dark, about 7 p. m. The day division boss briefed the night division boss on fire conditions and work done during the day. He emphasized that during the day the wind had been tricky and that difficulty had been experienced along the rim when burning-out operations were attempted. The night division boss discussed the conditions with his two sector bosses, and they agreed upon a plan of action. One sector boss and 1 crew boss with 20 inmates were to burn out along the tractor-built line on the canyon rim and down the hand line. Operations of this kind are normally carried out at night when winds subside and burning conditions are less hazardous.

The second sector boss with 3 crew bosses, the correctional officer, and 13 inmates was to complete the cutting and scraping of the hand trail to the river. The two sector bosses synchronized their watches at 7 : 18 p. m. and agreed to have a radio check at 7 : 55 p. m.

The plan went into operation with men going down the hand line and the tanker crew on the rim laying a hose to help hold the burning-out fire. One length of hose broke and some water was lost in replacing it. The water in the tanker was used up by 8 p. m.

The brush cutters in the 13-man trail-building crew started work as soon as they reached the point where the day crew had stopped work. The scrapers waited a few minutes until the cutters got a short piece of trail cleared. The boss of these scrapers lined out his men and gave them instructions on the work they were to do. He then went back up the fire trail toward the canyon rim to check on the burning-out work as the sector boss had previously instructed him to do.



A, B Tractor trails
C Fire trail (hand constructed)
D Small bluff on trail
E Chimney canyon
F Approximate location of crew when first warning was given
G Route of fire run
H Route of those who escaped
X Area where victims were trapped - disaster site

When the scraper crew boss got to the top of a small 15-foot bluff on the trail, approximately 75 feet in a direct line from the canyon rim, he noticed that the main fire was unexpectedly flaring up on a side ridge more than 1,000 feet below the men. Suddenly it made a short run toward the main ridge where the men were building trail. He called a warning to the men working on the fire trail below and told them to come out. One of the bosses below answered his warning.

The men stopped work and all started back up the trail at normal pace. This was at about 7 : 45 p. m. The men farthest down the hill had approximately 1,100 feet to travel up the trail. Survivors reported that there was no panic. Some of the men wondered why they were being called out. Most of them kept their tools. One even picked up a shovel and canteen abandoned by another.

The fire below suddenly gathered momentum and the crew boss on the top of the small bluff saw that it was now a real threat to the men below. This happened about 2 minutes after the first warning, and he again yelled to the men, telling them to hurry up. Most of the men now dropped their tools and began to go faster.

Two of the men stationed on the upper part of the line escaped before the fire reached the rim. Two others, who also had been working on the upper part of the line, stopped at a small open spot just below the rock bluff on the cleared line. Others pressed on up to them from below. Within a minute or two, 5 men who had been working lower on the line reached the 2 men waiting in the open spot. They were slightly ahead of the remaining nine men. By this time, the fire had outrun them to the right and had crossed the cleared trail above. These 5 men turned off to the left, climbed and struggled up the 15-foot rock bluff, and raced the remaining 75 feet to safety at 8 : 05 p. m. They reported later that, on this last stretch, the fire was only 10 feet behind them.

The 11 victims were cut off while still below the small bluff, presumably by an instantaneous "flashover" of a large area of fire. This sudden expansion of the fire front was testified to by the survivors and other nearby observers. In addition, two fire bosses on the opposite side of the main San Diego Canyon observed the action of the fire when it made its fatal run. They reported that it ran up the ravine beside the ridge where the men were working and across the fire trail near the top. At about the time the fire got to the rim, there was a sudden "flashover" to the left, which the observers said simultaneously ignited a large area, perhaps 40 acres. This explosive "flashover" enveloped the 11 victims just below the small bluff. It apparently was caused by ignition of gases forced up the ravine by the extremely rapid run of the fire.

All victims were found in an area with a radius of 45 feet, and the lowermost one was only 300 feet from the tractor-built line at the top of the canyon rim. The fire barely crossed this line in only a few places, where it was quickly put out. Of the men that escaped, two had been working at the very lowest part of the trail. Two who had been working closest to the rim did not escape.

Several of the fire fighters, including the forest officers who lost their lives, stayed with the crew until the last, helping and urging others out, even though they might otherwise have had an opportunity to escape. One of those who escaped credited a fellow crewman with saving his life when he became exhausted while climbing over the rock bluff.

Control of the fire

Before being controlled at 6 p. m., Wednesday, November 28, the fire burned 43,611 acres within the Cleveland National Forest and adjoining land protected by the State. The area burned had a 90-mile perimeter. At least five homes were destroyed. More than 2,000 men fought the fire, 1,300 under Forest Service supervision. These included 500 Indians (local and southwestern region), about 500 Navy personnel, 200 inmates from San Diego County and State honor camps, and other organized crews. These men, plus 3 helicopters, 4 air tanker planes, 2 scouting planes, 27 bulldozers, and a fleet of 90 stake, tank, and pickup trucks, formed one of the greatest arrays of men and equipment ever assembled to fight a forest fire in San Diego County.

Conclusions

A. Fire behavior.—The disastrous flareup of the Inaja fire was caused by a critical combination of highly flammable fuels, steep topography, and adverse weather. The lull in the fire before and at the time of arrival of the night crews created a false sense of security, even though existing conditions of fuel, topography, and weather were critical.

B. Crew location in canyon.—The men were taken down the line into the canyon, owing to a lack of information to show possible danger from the fire in the canyon below. The contributing factors were:

(*a*) Absence of specific information on the fire status in San Diego Canyon available for the briefing at the base camp, due to poor conditions for aerial reconnaissance.

(*b*) Emphasis placed on the danger of the burning-out fire rather than on the main fire in the canyon below, when the day division boss briefed the night overhead personnel.

(*c*) Quiet appearance of the fire as viewed from the rim.

(*d*) The night overhead personnel had not seen the terrain in daylight.

(*e*) Lack of detailed scouting of the canyon on sector G during the day.

(*f*) Absence of contact with the bosses of the division across the canyon who had a different vantage point for viewing the situation.

C. Trail location.—The location of the fire trail on the specific ridge where it was built, instead of the next spur ridge up the canyon, was questionable. The previous behavior of the fire, and the position above and alongside a precipitous chimney, made the chosen location hazardous.

D. Burning out.—Sound fire-fighting principles call for burning out the intervening fuels between the control line and the fire edge. The effect of the burning-out fire on the behavior of the main fire and on the planned escape routes is a vital factor influencing decisions on when, where, and how to burn out, and where to place men.

Fire behavior is not well enough understood to firmly establish the possible effect of the burning-out fire in sucking the main fire rapidly up the chimney at the site of the disaster. Other factors would have permitted the explosive run without the presence of the burning-out fire. Furthermore, the burning-out fire did not cut off the escape route.

E. Lookout.—The crew cutting line into the canyon received warning to come out when a crew boss on the upper part of the line saw the fire heating up at a point below the men. It is uncertain in the Inaja fire disaster that a specifically designated lookout would have given the warning any sooner. However, it is vital that a lookout be designated when crews are in a potentially dangerous location.

F. Water.—Exhausting the water supply from the tanker at the time of the flareup did not cause or contribute to the tragedy. The flames that raced up the canyon slope were of such height, and were extended so far in advance of the burning fuel, that water available from one or several ground tankers would not have had material effect.

G. Personnel.—The leaders on the Inaja fire were capable and experienced. They were trained in accordance with recognized Forest Service standards. There is, however, need for more intensive, advanced, fire-behavior training for key fire supervisory personnel.

Line crews on the sector where the tragedy occurred were experienced, trained fire fighters. Moreover, on this sector there were experienced overhead personnel from the local forest and from other forests.

Recommendations of the investigating team

A. It was strongly brought out by the investigation that better knowledge of fire behavior must be developed as an essential means of preventing future fire tragedies. Research studies even more comprehensive and penetrating than past and current fire-behavior research must be carried out to determine means of fighting mass fires and the behavior of fires in forested areas, especially in rough topography. In addition to progress in fire-control methods already made, new and more powerful methods of attacking mass fires are needed and must be developed. Such methods, like use of aerial attack with water and chemicals, may provide the means of controlling dangerous fires with less risk to human lives.

B. More experts on fire behavior must be developed for assignment to critical fires. These highly skilled experts would evaluate situations and assist fire bosses in making decisions for safe, effective fire fighting.

C. The investigators pointed out that, in general, although not related in particular to the Inaja fire, present Government salary and wage rates make it difficult to obtain and hold competent fire-control personnel. Controlling mass forest fires is a difficult and highly technical job. The specifications for these positions should be further reviewed with appropriate Department and Civil Service Commission officials.

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Working notes and data

The investigating team's voluminous notes, maps, photographs, analyses of weather records, fuel-moisture measurements, fire-behavior observations, information on training and experience of leaders, etc., are to be filed with the office copy of this report. Further study will be made of this material, and a Service memorandum will be prepared covering points which may be helpful to Forest Service officials having fire-control responsibilities.

Glossary

Base camp.—Same as main camp, in this case. See Main camp.

Control line.—See Handline.

Division.—A unit of a complex fire perimeter between designated topographical or cultural features (such as ridges, streams, and roads) organized into two or more sectors for control.

Fire trail.—Same as fireline. See Handline.

Fire weather.—Weather factors that affect the probability that forest fires will start and their rate of spread after starting. It is the composite of elements such as drought conditions, wind, and air temperature and relative humidity.

Flanks of a fire.—The parts of a fire's perimeter that are roughly parallel to the main direction of its spread or progress.

Handline.—A fireline or control line made with hand tools rather than machines such as bulldozers. A strip a few inches to several feet wide is scraped or dug to mineral soil so that fuel is absent and the fire's progress may be halted when it reaches the fireline. Sometimes a fireline is located some distance from the main fire, and then the intervening vegetation and fuels are purposely burned to make a much wider strip devoid of fuel. This is called backfiring or burning out.

Lookout.—A person designated to detect and report forest fires, from a vantage point such as a tower or a natural elevation.

Main camp.—Headquarters of the fire boss, who is responsible for all suppression and service activities at a fire. Same as fire headquarters.

Sector.—A designated segment of fire perimeter or control line comprising the suppression work unit for 2 or more crews under 1 sector boss.

Tanker.—A truck equipped to carry water or other liquids used in suppressing a fire.

Mr. CONNAUGHTON. We should continue the cooperation and strengthen it as it exists.

Mr. Chairman, we have appreciated the opportunity to discuss with you and members of your committee the circumstances that are associated with what we consider and, as you indicated, what you consider the most difficult fire problem that prevails in the country. We welcome your review of it. We welcome the opportunity to discuss it with you, and your suggestions, as determined by your deliberations, will be most welcome in our work.

(Mr. Connaughton's prepared statement follows:)

STATEMENT BY CHARLES A. CONNAUGHTON, REGIONAL FORESTER, CALIFORNIA REGION, FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE, RE FOREST SERVICE RESPONSIBILITIES FOR FOREST-FIRE CONTROL IN CALIFORNIA

Mr. Chairman and committee members, I am glad to make a statement on Forest Service fire-control responsibilities.

My statement will be in three parts: (1) A brief description of general Forest Service responsibilities and activities in wild-land fire prevention and suppression and their particular application to California including the problems of recent years associated with intensified use of the national forests; (2) the southern California forest-fire situation, and how the Forest Service fits into that picture; and (3) some comments on brush burning and fire.

FOREST SERVICE RESPONSIBILITIES IN WILD-LAND FIRE CONTROL

The Forest Service was created over a half century ago in 1905. It was given responsibility for administration of the forest reserves which had just been transferred from the Department of the Interior and renamed national forests. On June 30, 1957, there were 149 of these national forests in 39 States, Alaska,

and Puerto Rico, including 181 million Federal acres. In addition, the Forest Service has direct responsibility for wild-land fire control on 77 land-utilization projects, including an additional 7 million acres. In the California region there are 17 national forests with a net area of 19.3 million acres.

For many years the main job of the Forest Service was custodial. Principal duties were to prevent trespass and suppress fires. Fire fighting was the primary duty of practically all employees of the Service. I think it is generally recognized that the Forest Service pioneered in forest-fire control in this country.

The Forest Service has a complete fire organization staffed with qualified career people. Starting with the Division of Fire Control in the Chief's office, there are parallel organizations in each of our 10 regional offices and each of the 149 national forests. There is also a fire-research organization at our regional forest-experiment stations. Six fire-control centers are operated for smokejumpers in the West. In addition, there are of course the district rangers, who are the trained leaders of our on-the-ground work. In times of peak fire activity we add many thousand temporary employees to the rolls.

The Forest Service, through its research organization, has responsibility for all Federal forest-fire research. In addition, the Forest Service maintains major equipment development centers at Arcadia, Calif., and Missoula, Mont. Many of the important techniques and equipment now commonly used in fire suppression were pioneered by the Forest Service for its own use and for other agencies. Some of these include tractor plows for fire-line construction, powered brush cutters, powered fire-line trenchers, techniques for fighting fire from the air, portable two-way voice radios, special fire pumpers, lightweight hose, and evaluation of fire danger through measurement of a combination of climatic and other factors. The Forest Service smokejumper corps was a forerunner of the Army paratroopers.

One of the more profitable research projects was the study known as Operation Firestop, conducted in southern California. Industry, city, county, State, Defense Department, and other Federal agencies combined forces in 1954 to concentrate research and development effort on new methods of forest-fire control. The total value of their contributed effort was one-half million dollars. Firestop developed the technique of bombing fires with chemicals dropped, uncontained, from airplanes. It tested several ways to use helicopters as fire-fighting tools. It conducted special studies of fire weather and fire behavior. All of these approaches advanced our knowledge.

During 1956, several of the developments started during Operation Firestop became practical fire-fighting measures. Air tankers joined ground fire-fighting forces on 25 fires by dropping 1,350 loads of water and chemical. Ground tankers made chemical attack on 23 fires. Hose-lay trays, now in regular production, were used to lay hose by helicopter on two fires. In the current year these modern fire-attack methods have been used on more fires and to a greater extent. Cooperative study projects between research groups and fire fighters continue at a scale unknown in the past.

On the public-relations front, too, there has been much progress. For 15 consecutive years the Forest Service, the Advertising Council, and State Foresters have jointly conducted a nationwide public-service campaign for forest-fire prevention. This campaign was originally conceived in southern California. Since 1942, the number of forest fires in the Nation has decreased about 30 percent. Man-caused fires in California national forests have declined from an average of 1,033 per year in the early 1930's to an average of 656 per year in the past 5 years.

Despite the wide scope and long history of Forest Service responsibilities in fire control, we have been hard-pressed since the end of World War II to keep on top of the situation. This is due to two factors: (1) Increased use of the national forests, and (2) rising costs.

Most of the national forests are in the West. The urban, industrial, and agricultural expansion of the West since 1945 is well known. In the 10-year period 1946–56, the population of the 11 Western States jumped 32 percent. The national forests, particularly those around metropolitan areas such as in southern California, Portland, Seattle, and Salt Lake, have been greatly affected by this impact.

Recreation visits to national forests of the Nation have jumped from 18.2 million in 1946 to 45.7 million in 1955. In California the increase in this period has been from 3.9 to 7.7 million. This means more chances for a wildfire from a campfire getting away, a tossed cigarette, or from other acts of carelessness. The volume of timber cut has increased from 2.9 to 6.4 billion board-

feet in this same 10-year period. In this State the timber cut has steadily increased to a present cut of more than 800 million board-feet per year. This increases the likelihood of fires in logging slash. The recent great upsurge in mining, and the increase in number of claims countrywide to 200,000 in 1955, means more people in the woods. Special-use permits for summer homes, stores, rights-of-way, et cetera, have increased from 46,000 in 1946 to 55,000 in 1955. More than 18,000 of these are in our California national forests. The Forest Service welcomes this increased use, but it does create additional problems of fire prevention and suppression.

Increased costs are evident in many ways such as higher hourly wage rates, overtime pay, and an upswing in the costs of equipment and supplies. A lookout or fire-crew man costs 3 times more today than 15 years ago. Overtime is an important factor because our fire services must operate on a 7-day week, and often on a 24-hour day. Fire-equipment costs doubled between 1940 and 1950 and have continued to increase.

Congress has recognized this situation through increases in appropriations. The total funds appropriated for national-forest fire control increased from $14.7 million in 1950 to $20.7 million in fiscal year 1957. Despite our best efforts to offset rising costs by improved mechanization and technology the total cost for fire control per acre has increased substantially.

THE SOUTHERN CALIFORNIA FIRE SITUATION

The forest-fire problem in southern California is without parallel in the United States. It is due basically to two factors: (1) Concentration in a small semiarid area of a high population and intensive industrial and agricultural development; (2) bordering this area are steep mountains with highly erodible soils, and highly flammable brush cover. These mountains are extremely important sources of water to the valley and urban populations. The proximity of the mountains to the people is such that floods and mud and rock flows from denuded slopes do serious damage. Repeatedly, floods and mud and rock flows have followed large fires in this area.

Southern California includes about one-tenth of the State but has more than one-half of the State's population. It is one of the fastest growing regions in the United States. There were 3.7 million people there in 1940, 6.8 in 1954, and the estimates are for 9 million in 1965. Expansion is so fast that highly valuable citrus groves are giving way to homes. The suburbs are expanding into the canyons and onto the brushy slopes of the mountains. This expansion means more water is consumed and it also subjects the valuable homes and improvements to the danger of fire and floods.

The role played by this southern California area in the national economy is remarkable. Southern California alone accounts for 4 percent of the Nation's population, 6 percent of its motor vehicles, 5 percent of its retail sales, 5 percent of the value added by manufacturers, 5 percent of its mineral production, 2.5 percent of its cash farm income, over 10 percent of its truck crops, more than 30 percent of the citrus fruits, and over 50 percent of the aircraft manufacturers. It is the center of the motion-picture industry, has important ocean ports, and vital military, air, and naval bases.

In southern California about 7.3 million acres, or 25 percent of the total land area, is considered to be water-yielding area. Despite vast expenditures for water developments and the bringing of water from the Colorado and Owens Rivers, about three-fourths of the total annual water used in the south coastal basin still comes from these local watersheds. Ninety percent of the local water is produced from 3.5 million acres classed as major water-yielding area. Most of this is on national-forest land. Thus it could be said that the national forests of southern California produce roughly half of the total water used in the south coastal basin, which includes the Los Angeles, San Diego, and San Bernardino metropolitan areas. The water problem is further aggravated by the fact that present annual use of local water from underground basins exceeds the safe yield.

Studies of 12 southern California watersheds located mainly on national forests and averaging 73 square miles show that if they were completely burned, flood peak for major storms would be tripled in the first year after burning, while peak flows for smaller storms would be increased as much as 10 to 20 times. But of even more significance is the probable increase in the erosion rate. The normal erosion rate is 115,000 cubic yards annually. The first year following burning, the rate could increase about 30 times if a normal series of storms occurred.

These facts of (*a*) dependence on local water, (*b*) high flood peaks, and (*c*) extreme erosion following burning, show how vital the mountain brushlands are to southern California, and how vital the problem of fire control is on these brush-covered mountains.

In recent years, two factors have combined to make what is typically the most difficult fire-control job in the country even more difficult. These are (1) severe fire weather, and (2) increased use.

Southern California is in the midst of a continuing drought. Precipitation, humidity, and soil moisture are below average. Temperatures and wind velocities have been high. The drought has been continuing since 1945. With each succeeding year the flammability of the brush cover rises. The rapid spread of recent large fires is directly traceable to the accumulated effects of a long and continuing severe drought.

The main factors affecting the start and spread of fire, such as wind, temperature, fuel moisture, and humidity are combined into a scientifically designed fire-danger rating system. Each day the fire danger is measured. Measurements for 1956 clearly indicate that the potential for more and larger fires was greater than for any season in the past 15 years. The bad burning conditions started earlier, stayed consistently high, and lasted longer than normal. Fire danger in southern California is such that major fires can and have occurred in every month of the year.

As the population of southern California has grown, so has the intensity of use of the watershed lands. For example, in 1954, there were 13.3 million man-days of recreational use on these watersheds at over 600 separate recreation areas. Hunting and fishing were heavy on the 58 lakes and nearly 800 miles of fishing streams. Also, on the watershed lands are some 186 small residential communities, 88 industrial areas, 1,200 miles of power transmission lines, nearly 600 miles of gas and oil lines, over 4,000 miles of main-travel highways, and over 300 miles of railroads. All of this use contributes to fire hazard.

The wild-land fire control job in southern California is performed primarily by the California State Division of Forestry, county fire departments, and the Forest Service. These three agencies protect 98 percent of the 7.3 million acres of watershed land. Forty-seven percent of this is protected by the Forest Service, about 31 percent by the State division of forestry, and 20 percent by the county fire departments. Military and local fire districts protect smaller acreages.

The State and county fire organizations use the latest techniques and are highly competent. Reciprocal arrangements are in effect between the Forest Service, the State, and the counties, and on large fires all three agencies pool their resources. The cooperative arrangements in southern California are outstanding in the United States. In addition, the Forest Service when necessary augments its local staff by drawing experienced supervisory personnel from other parts of the country to assist on fires in southern California.

The history of fire occurrence on the national forests in southern California is indicative of the difficulty of the situation. These 4 national forests with an area of 2.8 million acres are located in 7 counties. In the 6-year period 1951–56, they had 1,505 fires. Each of these had disaster potential. Ninety-eight percent of them were held to less than 1,000 acres. About 1.5 percent burned between 1,000 and 10,000 acres, and less than 1 percent (only 10 fires), burned over 10,000 acres each. Although I think this is a good record, we are far from satisfied with it. Nowhere else in the United States do we have so many large fires on the national forests.

Another indication of the southern California fire problem is that there the average-size fire on national-forest land in 1956 was 227 acres. This contrasts with 31 acres on all national forests in California and 19 acres for all national forests in the country. It has been possible to reduce the average size of fires in the last decade about one-third for all national forests, but in southern California there is no significant trend toward reduced average size.

In the latter part of 1956, there were four very large forest fires in southern California. In the aggregate, they burned about 100,000 acres. They were on two national forests and in parts of four counties. Of these, only the Malibu fire was not on national forest land. The State, county, and Forest Service cooperated on these fires.

Because of the tremendous intensity of southern California fires and their erratic behavior, tragic losses of firefighters have occurred. For example, in 1933 within Griffith Park in the city of Los Angeles, 28 firefighters lost their lives

by burning and an additional 128 were treated for injuries. In 1943, 10 military personnel lost their lives in a fire on the Cleveland National Forest; in 1955 a captain of the Los Angeles County Fire Department and 4 firefighters lost their lives in a wild-land fire; and in November 1956 11 members of a Forest Service crew on the Inaja fire on the Cleveland National Forest lost their lives. These are not all the fatalities, but they point out what can happen. Men have also burned to death in northern California and in other States. The Inaja fire was promptly investigated by a board of review appointed by the Chief of the Forest Service. I would like to file with the committee the report of the Forest Service on that fire.

The Forest Service recognizes the hazard to its personnel and works constantly to meet it through a servicewide safety program and through special training and equipment for fire-fighting forces. Heading up the safety program in the Chief's office in Washington and in each regional office is a safety officer. Each national forest has a staff officer designated to concentrate on safety. District rangers and foremen carry the program to the men on the ground to make safety an alive, everyday habit.

The immediate problem after major fires are controlled, is to get vegetative cover on the ground in order to reduce the high hazard from floods and erosion. The increase in flood peaks and erosion rates following fires emphasizes this need. Under the authority of the Flood Control Act of 1950, the Secretary of Agriculture is authorized to undertake emergency measures to retard runoff and prevent soil erosion to safeguard lives and property whenever fire or other natural elements have caused a sudden impairment of the watershed. Federal expenditures are limited to $300,000 annually. The work can be done on land in any ownership.

In the past 5 years, emergency treatment has been carried out on 28 watersheds in the United States, and all but 1 was following fire. Twenty-one of these watersheds were in southern California. Treatments included 175,000 acres of seeding, 14 emergency debris basins, and 50 miles of channel clearing. Federal expenditure totaled over $700,000 and State and local participation more than $500,000.

BRUSH BURNING AND FIRE

I would like to talk briefly about the planned use of fire for reducing hazards and fuels to assist fire control.

Brushlands in California have been a challenge to landowners and others since the first settlers arrived. Gold miners burned brush, timber, and litter to expose quartz outcroppings. Early-day stockmen burned to open up the brush to produce succulent sprouts. Loggers burned slash to reduce fire hazards adjacent to unlogged areas. And I want to emphasize that the Forest Service, too, believes in the use of fire as a tool in land management.

Fire properly handled can be, and is, used to reduce hazards and fuel in situations where proven advantages result. Similarly, I want to emphasize that the Forest Service does not believe in promiscuous use of fire. In short, we do not believe that the use of fire for brush removal can be generalized. Each specific situation must be evaluated on its own merits.

The Forest Service frequently uses fire as a management tool. In the Southern States, for example, prescribed burning and chemicals have been used to control hardwoods and increase the proportion of pine. Broadcast burning in the Northwest following logging is a well-established practice to dispose of the slash hazard and to make conditions favorable for seedling regeneration. About 600,000 acres of sagebrush, largely in the Great Basin, have been treated by prescribed burning, chemical, and mechanical methods to increase forage. In the Southwest, some 80,000 acres of juniper, mostly in Arizona, have been controlled to increase forage production. This was mainly by mechanical means, but it demonstrates the Forest Service policy of improving vegetation with proper conditions and methods.

There are some 20 million acres of brush outside the commercial timber zone in California. About 14 million acres of this is north of the Tehachapi Mountains and 6 million acres south of that range. About 22 percent of this total brushland area is located on national-forest land.

Managing brush-covered lands is a significantly different problem in northern and southern Califoria. In northern California, topography, climate, and soil offer more opportunities to remove the brush and replace it with a plant cover of more direct economic value to grazing, wildlife, and timber interests. In southern California, conditions are less favorable for conversion to other cover,

and watershed protection transcends all other values. In general, the mountain slopes have never supported anything but chaparral brush. With brush present, nature exercises reasonably good control over the mountains in preventing sources of flood and damaging debris. Without the brush, erosion and flood are rampant.

Possibly there is no other locale on the face of the earth where a large population is so directly dependent upon the vegetative mantle on its watersheds. The excessively steep mountains are so close to millions of people that uncontrolled runoff poses a constant threat. Conversely, the same closely situated watersheds are invaluable in furnishing water to meet local domestic, industrial, and agricultural needs. Uncontrolled runoff on fire-denuded slopes not only results in quick, flash flows, but carries tremendous quantities of soil and boulders downstream.

Such terrific discharges of debris-laden water have taken many lives and destroyed vast amounts of property. To control these catastrophic floods, many dams and debris basins have been constructed. After the floods, these debris basins are cleared and the material is hauled away. The costs are extraordinarily heavy, often more than $3 per cubic yards, and then repeated after the next storm. One-half billion dollars has already been spent in Los Angeles County alone on downstream flood control. Another half billion dollars is still planned. Worse yet, the runoff water from these storms cannot be profitably impounded.

The question is often asked, Can southern California's brush be replaced with vegetation less flammable or in which fire could be more easily controlled? A search for plants that will meet these and other attributes is underway. Of the many plants tested six species show promise of being able to withstand both the long, dry summers and the poor, shallow soils of the southern California mountains.

Frequently proposals are made to "light burn" or "strip burn" southern California chaparral lands during the winter as a hazard-reduction measure. This practice does present possibilities but is much more complicated and expensive than commonly assumed. Usually chaparral in the south either won't burn at all or burns with such intensity that it is difficult to control. Thorough preparation is necessary to burn the brush and confine the fire to the area desired. This pretreatment includes firebreaks and smashing the brush with a tractor or spraying it with chemicals to increase flammability. The work is costly. If the fire does not burn hot enough to clean up the fuels the effort is a waste of time and money. If it burns hot enough to do the job it requires extraordinary measures to keep it under control. And then the soil exposed to winter rains must be revegetated to prevent excess runoff. Without these precautions the results are the same as from wildfire.

In northern California a different situation prevails. Opportunities for changing brush to grass or trees or even to different kinds of brush more palatable to livestock and big game are greater for several reasons. The brush-covered slopes are generally not as steep. The soils in many places will grow other plants. Weather conditions are not as critical either for controlling the burn or for plant growth. At one time many northern California brushlands supported other vegetation. This is particularly so in the sagebrush lands of the northeast plateau and in the woodland-chaparral belt around the Central Valley. These lands often offer excellent opportunities for conversion to grass. Several State and Federal agencies are working on problems of conversion along with ranchers and others.

The Forest Service is converting brushlands in several national forests in California. Fire, mechanical equipment, and brush-killing chemicals are being used. Work is limited to slopes where erosion will not be excessively accelerated and confined to soils shown by prior analysis to be capable of growing plants more valuable than the brush that is removed.

Currently there are 33 conversion projects covering some 42,000 acres, with the most intensive work concentrated on the Mendocino National Forest. Most of the jobs involve use of fire in one way or another to remove brush or convert it to more usable species of brush. The objectives of the work include increasing forage for domestic livestock, better fire control through developing fire lanes and buffer strips, improving sites for tree planting, and improving conditions for wildlife.

About 500,000 acres of brush within the national forests probably can be treated successfully with presently known techniques. Costs vary from about 60 cents per acre for burning alone on favorable situations to as much as $50 per acre in critical areas where a complete job of brush removal, seedbed preparation, planting, and erosion prevention is done. This program will proceed as

rapidly as practicable and research is being continued to find out how to do the job cheaper, safer, and more effectively.

In summary, the Forest Service policy with respect to brush burning in California may be stated in three points:

(*a*) On steep slopes with highly erodible soils, particularly where brush is the climax type, as is the usual case in southern California, broadcast burning should not be used to reduce fire hazard. Fire can be used in a limited way under careful control to prepare fire lanes. The Forest Service believes that improved fire control is the best policy under those conditions. Experience tells us that the danger of floods, accelerated erosion, mud and rock flows, is too great if the protective brush and other cover is removed. This hazard is accentuated in southern California by the concentrations of people and high property values immediately at the base of the mountains. There is no known practical way to establish and maintain a permanent grass cover on such areas.

(*b*) Even on areas with gentler slopes and more stable soils, which are found mainly in northern California, the Forest Service does not favor indiscriminate burning. We oppose indiscriminate burning because it will not be successful in a great many areas, it will result in waste of money, and it will often be followed by accelerated erosion and runoff.

(*c*) On areas of gentler slopes and more stable soils, the Forest Service favors alteration or elimination of the brush cover by fire or other means under controlled conditions. The Forest Service is carrying out such a program on selected areas under its administration. Eventually, we feel that with improved knowledge and adequate funds and facilities, about one-half million acres of brushland in the national forests of California may be properly subjected to treatment.

THE JOB AHEAD

In closing, I would like to review what is needed to cope with the fire problem in California. A prime need is to bring the organization up to full planned strength. This should provide for yearlong employment for some key fire personnel. To recruit and hold desirable personnel, pay scales should be competitive, career opportunities should be available for fire technicians, and their quarters and equipment should be acceptable in quality and quantity. Newer types of equipment—like helicopters, air tankers, and chemical units—are needed and experimentation with these new tools and techniques must be continued. Quicker routes of access are necessary to make the most of these forces and a system of heliports equipped with water storage supplies.

Now just briefly, what is needed specifically for fire control in southern California? I can speak only for the national forests, but there we need to do a better job than we have been doing. It's not good enough when 36 fires burn more than 1,000 acres apiece in a 6-year period. It's not good enough when the average-size national-forest fire in southern California is 12 times the national average.

What should be our objective for protecting these national-forest-watershed lands of southern California? A realistic objective cannot be to prevent all man-caused fires from occurring; nor can it be to keep every fire below say a half-acre in size. Such objectives would be prohibitively costly and impractical. Considering costs of prevention, costs of suppression, costs of rehabilitation, fire occurrence, fire danger, and fire damage, our considered objective on the southern California forests is twofold: (1) To let no fire exceed 2,000 acres, and (2) to keep the annual area burned to a total of less than 5,600 acres annually. This would be fifteen one-hundredths of 1 percent of the total area protected.

We have not come close to meeting this objective. Only once was it attained in the past 31 years, and in only 3 other years did we come close. In 10 out of the past 30 years, more than 8 times the annual allowable area of 5,600 acres was burned.

Yet southern California has been well treated in relation to total Forest Service funds and facilities. The following tabulation shows that the four southern California forests received in fiscal year 1957 roughly 25 percent of the total funds available to the Forest Service for national-forest-fire control. It also shows that these 4 forests, which receive 25 percent of the funds, represent only 2 percent of the area that the Forest Service protects. In terms of expenditures per protected acre, the national average is 10 cents. For all national forests in California it is 41 cents, but for the 4 southern California national forests it is $1.30 per acre.

Unit	Fire-control funds expended, fiscal year 1957		Area protected		Funds per protected acres
	Million	*Percent*	*Million acres*	*Percent*	
All national forests and associated lands	[1] $20.7	100	199	100	$0.10
All California national forests	[1] 9.4	45	23	12	.41
4 southern California national forests	[1] 5.2	25	4	2	1.30

[1] Includes expenditures from following appropriations: (*a*) National-forest protection and management:; (*b*) forest-fire fighting; and (*c*) flood prevention.

A basic need in the southern California forests is increased manning. Another is manning throughout the year. Normally, these forests are manned for fire control from about May 15 to November 15. Yearlong manning is needed, although at a somewhat reduced level from the peak periods in the fall. Yearlong manning includes several things. It means that crew foremen, tank-truck operators, key fire managers, and prevention workers will be employed yearlong. It also includes additional needs for short-term personnel, fuller use of aerial techniques, certain additional equipment, and such capital investments as firebreaks, housing, water developments, and roads. Of special importance are aircraft and roads.

Hazardous fuels should be eliminated or greatly reduced at many strategic locations where fires are likely to start. To make fire control easier solid expanses of brush should be broken up by buffer strips at strategic locations through increased use of such known techniques as controlled fire in combination with mechanical and chemical means. Barriers and firebreaks could be used more effectively if more water-storage facilities were provided. We plan to move as quickly as funds, facilities, and other needs permit to man the four southern California national forests on a yearlong basis.

The job in southern California will take the coordinated efforts of all protection agencies and the general public. The place that each can play is pretty well defined. There is no cheap, no easy way. We are convinced, however, that an acceptable job within allowable limits can be achieved and our cooperating agencies have a similar reaction.

That concludes my statement, Mr. Chairman. We appreciate the interest of the committee in the problem of fire control in California. It is one of the most complex administrative problems facing the Forest Service. We think we are making progress, and we think our policies are sound. However, we do not have fixed ideas on any aspect of the problem, and our minds are always open to helpful suggestions. We welcome this study by your committee and I shall be happy to try to answer your questions.

The CHAIRMAN. Thank you very much, Mr. Connaughton. If you will remain in the front row, we will ask State Forester Raymond to make his statement, followed by the others, and then we will address questions to you en bloc.

Mr. Raymond, we appreciate your appearance here. Will it be possible for you to summarize your statement in 10 minutes, or approximately that?

Mr. RAYMOND. I will do my best, Mr. Chairman. I think I can do that.

The CHAIRMAN. It would be of interest to the committee if, in your summary, you indicated the relationship between the national-forest areas which are under the responsibility of the United States Forest Service and those over which you have control. I know they are intermixed to a certain extent, but I am sure some of our friends from the other parts of the Nation may not realize how closely you people have to work together.

STATEMENT OF STATE FORESTER F. H. RAYMOND, CALIFORNIA DIVISION OF FORESTRY, CALIFORNIA DEPARTMENT OF NATURAL RESOURCES, SACRAMENTO, CALIF.

Mr. RAYMOND. Thank you, Mr. Chairman.

In this prepared statement we have attempted to set forth the problems on a statewide basis, but also to emphasize the particular problems of southern California.

We have noted in this statement the physical setting, the geology and physiography the climate, soils, and vegetation in the interrelated problem.

We have also tried to point up the resource values, primarily in the field of water production and flood control, and including recreation, grazing, and timber.

Also, we have pointed up in this report the State fire-protection responsibility, which is statutory in California and which prescribes the responsibility to the Division of Forestry for the protection of the State and private lands.

In the administration of this fire-protection system, the Division of Forestry is directly responsible for the protection of 31.6 million acres. By direct protection the Division of Forestry handles 22.8 million acres and contracts with several counties 3.2 million acres. These several counties have been noted in this report. Several of these are in southern California, including Santa Barbara, Ventura, and Los Angeles.

The protection problem is particularly emphasized because of the nature of these lands and the intermingling of State, private, and Federal lands, not only those of the Forest Service but other agencies.

We have had many problems developing in California, and the State board of forestry requested that a fire plan be developed so that proper attention could be given the fire-protection system to give it some better efficiency than it had before.

In 1956 such a plan was developed. This includes approximately an increase of $6 million to be implemented by the legislature over a 4-year period.

Approximately $2 million of that was appropriated for this fiscal year, and it is anticipated that almost another amount equal to that will be appropriated this next fiscal year.

Generally that gives you the statewide picture, but I would like to read to you a summary statement which is included here because we feel that it is very important to look at the whole problem.

Nowhere else in the world is there such a vast metropolitan area so directly affected by its "backyard" watershed lands as is southern California. In 1940, in this one-tenth of the State's area, there were a little over 3½ million people, with 55 percent of the State's assessed valuation. Today 8 million people live in this same area, with a comparable growth in economic wealth. This is the fastest-growing region in the United States.

The climatic conditions, the steep rugged terrain, the heavily populated areas adjacent to and actually in these important watersheds make the problem of fire control one of the most difficult found anywhere in the world. Because of the highly inflammable vegetation, the public use, and built-up areas, many fires cannot be controlled at

the time and place the professional forest-fire fighter would choose. To prevent the loss of life and the destruction of valuable property, he is often forced to take great personal risks, far beyond the call of duty, to control many fires in southern California.

Because of geographical and landownership patterns, the State, Federal, and county forest fire protection responsibilities are intermingled in California and especially in southern California. For example, the bulk of the steeper brush watersheds on the San Bernardino Mountains are in the national forest. However, the State protects a fringe of watershed land surrounding the national forest. The protection of this area is vital to the national forest, as fires originating in it are a direct threat to the Federal lands. Conversely, much damage to downstream improvements can result from fires in the national forests.

Recognizing that the problem of fire control has such importance to the very existence of this area as a vital part of our national economy, the forestry agencies—Federal, State, and county—to a large degree pool their resources in a common cause of fire control. Even with this pooling of resources and excellent cooperation between agencies so that the control effort is coordinated as one effective team, too often the story is that of too little too late.

I would like to point out that during the fall and winter periods, from October to January, approximately 35 percent of the annual loss occurs at that time in southern California. Approximately 10 percent of the loss occurs in the north at that time. This loss, as has been pointed out by Mr. Connaughton, is due to the extreme dry periods, and particularly to the Santa Ana winds which are a characteristic of this area.

I have here an order which is just being issued from my office which will prepare for the moving into southern California from northern California of 25 fire trucks, 10 bulldozers, and 5 service units, with the foremen, drivers, and equipment operators it will take to make this equipment effective should we have such an outbreak as we have had in southern California in the past. We are calling this the Santa Ana task force, and we hope to prove 1 of 2 things: either we will put out the fires as soon as they start or else we might make it rain, 1 of the 2.

The personnel of these forestry agencies have recognized their position of leadership in fire protection. There is a growing understanding of fire behavior, new techniques in fire suppression, such as the pre-fire-control operations—firebreaks, developed water supplies, safety islands, et cetera—the new tools—helicopters, fixed-wing aerial tankers, hose-laying equipment—and a constant striving for a more adequate professional fire-fighting organization to meet this fire problem.

It was in this area that Operation Fire Stop, as Mr. Connaughton mentioned it a while ago, was conceived and became, in reality, a program of complete cooperation between all concerned agencies of government and industry, a cooperative program that has advanced fire-control methods and techniques many years. The United States Forest Service has been a very important part of this program, to find the answers to the watershed fire problem. Nowhere else in the Nation do you find the encouragement and support of the citizen in the giving of his free time to this problem, and nowhere else do you find

such cooperation and pooling of resources by all agencies in combating this fire menace.

The area of greatest threat to life and property from the fuel hazard is on the precipitous watershed slopes. Even though the existing watershed cover creates a hazard, there is still a greater hazard when the slopes are burned. When these slopes are denuded by fire, valuable areas below are exposed to severe damage from accelerated erosion and flood flows. The standard tool of fighting fire with fire by denuding vast areas is thus generally impractical. Even in the physical control of a going fire the use of this tool is often ineffective, as the fire often burns with such intensity that it can only be compared with an actual explosion. This condition has been accentuated by several years of subnormal rainfall resulting in abnormal amounts of dead brush. To use fire as a tool at times of the year when it is safe to use fire in many other parts of the Nation is very difficult, as fire is unpredictable with our present knowledge because of the desert winds and rugged terrain. When it is safe to burn the brush, it will not burn; when it is burnable, it cannot always be controlled.

An adequate appropriation of funds for needed prefire control activities and inadequate suppression organizations has forced the forest agencies entirely too much to crisis management. Such management delegates advanced programing and treatment to a minor role; thus emergencies are constantly developing and are soon out of control. The California State Legislature recognized that such management was not in the best interest of the State and supported the California Division of Forestry's 1956 fire plan which would give an overall increase in efficiency of protection to lands of State responsibility. This program, to be accomplished over a period of a few years, will increase State appropriations for fire control by approximately 50 percent. The California Division of Forestry's fire-control program needs are as follows:

1. Retain our key personnel on year-round employment. Firefighting in southern California is often a year-round job. Many major fires occur in December and January.

2. Establish initial attack manpower strength to recognized forest fire control standards. To prevent disastrous fires in southern California, fires must be controlled in the initial attack stages.

3. Strengthen all phases of fire prevention activities, including law enforcement, education, and hazard reduction.

4. Increase effectiveness through a formalized training center now established. Firefighting in southern California must be professionalized. Proficiency in skills needed can only be obtained by trained key personnel.

5. Develop operation prefire control, the result of which, through land treatment, will reduce the size of watershed fires and will reduce the wild land fire threat to life and property. This program of firebreaks, fire access roads, cistern developments, and safety islands is well underway in the State-responsibility areas.

6. Continue the forest fire research program to accomplish immediate results. This experimentation includes fire weather studies, firebreaks, use of chemicals, air attack, mechanized equipment, sprinkler systems, development of fire-resistant vegetation, and so forth.

Local governments of the southern counties, through their boards of supervisors, also recognized this most important problem by sup-

plementing their contribution to the Federal and State Governments through increased appropriations for additional fire prevention and firefighting strength in these watershed lands; this in areas where the primary responsibility is that of the Federal Government and the State.

The California Board of Forestry is on record requesting the Federal Government to more adequately meet their responsibility on federally owned lands. Fire control preplanning, pre-fire-control land treatment, adequate initial attack fire suppression forces, and fire research are the objectives of the fire-control agencies in southern California. These include the United States Forest Service. The objectives can only be accomplished when there is an adequate appropriation of funds by the respective legislative bodies. The California State Legislature is meeting its responsibility; the boards of supervisors of the southern counties are meeting their responsibility; is it not true that Congress has a share in this responsibility?

I thank you, Mr. Chairman, for the opportunity to present this to the committee.

(The rest of the prepared statement submitted by Mr. Raymond follows:)

Report of California Division of Forestry, prepared for the Committee on Interior and Insular Affairs, House of Representatives, submitted by F. H. Raymond, State forester

SOME ASPECTS OF FIRE PROTECTION AND WATERSHED MANAGEMENT IN SOUTHERN CALIFORNIA

The Physical Setting

To appreciate the problems connected with fire control and prevention, and with watershed management, in southern California one must have an understanding of the physical environment and the interrelationships between vegetation, watersheds, and fire that exist here. This physical environment is distinctive, embracing a number of facets not encountered in similar combinations anywhere else in the State.

GEOLOGY AND PHYSIOGRAPHY

Southern California, west of the Mojave and Colorado Deserts, is constituted of two dissimilar physiographic provinces—the Transverse Ranges and the Peninsular Ranges.

At their southern end the California Coast Ranges are ended abruptly by the Transverse Ranges—a complex series of mountain ranges and valleys distinguished by a dominant east-west trend, in marked contrast to the northwest-southeast direction of the Coast Ranges to the north and the Peninsular Ranges to the south. The Transverse Ranges include the Santa Ynez and nearby low mountain groups with their included valleys; the Santa Monica Mountains; the San Gabriel Mountains; and the San Bernardino Range. Topography of all these mountains is very rugged, with a number of peaks extending more than 10,000 feet above sea level. The mountain streams, flowing down these steep grades, have cut deep narrow gorges into the flanks of the ranges. The San Gabriel Mountains and San Bernardino Range form an imposing barrier facing the desert along the southeastern portion of this region, both ranges being consituted of a series of faulted blocks thrust upward from a region of relatively low relief. Having been elevated to their present height only during Pleistocene time, these mountains are quite young; mountain-building and mountain-leveling processes—faulting and erosion—still are very active here, and are of much significance in the problems under consideration.

The Peninsular Ranges occupy the southwestern portion of California, together with an adjacent belt of marine terraces along their western margin; they include the Los Angeles Basin as well as the offshore island group and surrounding Continental Shelf. The mountainous section of this region is a series

of ranges separated by valleys trending from northwest to southeast, conditioned by erosion along faults that represent active branches of the San Andreas system. The trend of the topography is much like that of the Coast Ranges, but the geology is more like the Sierra Nevada, the dominating rocks being granitic. Viewed as a whole, the Peninsular Ranges are a gigantic fault block that has been raised by tilting upward on the eastern side like the Sierra Nevada. Most of the higher elevations are located near the eastern face, the highest point being Mount San Jacinto (10,508 feet); a considerable area lies at more than 6,000 feet above sea level, and from these elevated portions there is a relatively gradual slope to the west.

CLIMATE

California often is characterized as a region of Mediterranean climate. Actually, no less than five distinctive climates are found within this State. The kind of climate correctly designated as "Mediterranean" occurs over only about one-half the area of the State—and at least four different subdivisions of this Mediterranean climate are recognized. Under this situation it is unlikely that any extensive portion of the State could be found having a climate that falls entirely within a single category.

In southern California two quite different kinds of climate prevail, each occupying about one-half the total area of the region. The coastal lowlands and inland valleys have a hot grassland climate, characterized by an average annual rainfall between 9.5 and 14 inches; a mean annual temperature of at least 55° F.; and an average temperature of not less than 32° F. during the coldest month. A small area near the coast in San Diego and vicinity has a desert climate.

The mountainous portions of southern California are characterized by the hot-summer type of Mediterranean climate, the average temperature of the warmest month being above 71° F. The long, hot, dry summer of this climate often is given great emphasis. Equal or greater stress should be placed upon 2 other factors of the Mediterranean climate when the growth of plants is under consideration: winters are cool, with the average temperature of the coolest month between 64.4° and 32° F.; and at least 3 times as much rainfall is received during the wettest winter month as occurs during the driest summer month. Because of their opposite effects, both the hot, dry summer and the cool, wet winter are extremely significant as climatic factors for plant growth.

Some of the peculiarities of the climate of southern California arises from the effects of the mountains on precipitation. Winter storms and their associated frontal systems bring most of the precipitation to southern California. Prevailing winds bring these storms from the ocean to the west and south, and most of their moisture is deposited on the western slopes of the mountains as the storms rise above the highland. Frequently these storms bring rains that are torrential in character, for a very large part of the precipitation each season is received from a very few storms. Degenerate tropical storms occasionally move far enough north to affect the southern part of the State, having been responsible for some of the historic local storms of this area. The frequent high intensity of rainfall poses still other problems in wild land management from the standpoint of soil erosion, as will become evident further on.

SOILS

Wild lands of southern California—as well as great areas that have become urbanized—are characterized by residual soils, developed in place from granitic, serpentine, or sedimentary bedrock. They vary from medium to very shallow in depth, usually are stony, and quite variable in color and reaction. To a very great extent they are young soils, in the early stages of formation. Commonly these soils are low in nutrients required for plant growth, or the nutrients present are not in a suitable state of balance. Occurring on hilly to very steep mountainous topography, in an area that is geologically young and still subject to active mountain-forming processes, and often being coarse-textured with low water-holding capacity, these soils provide poor sites for the growth of most plants. In addition they are subject to normal or geologic erosion to a degree probably not exceeded elsewhere in the State, even when their cover of vegetation is undisturbed. Frequent high intensity rainfall aggravates this condition. When the plant cover is disturbed or removed the hazard of accelerated erosion is increased manyfold.

VEGETATION

In response to the individual and collective influence of this complex of physiography, climate, and soils, a great diversity of plant cover has developed. Aside from the deserts the most extensive plant communities are chapparral and sagebrush, which together occupy nearly 5.3 million acres in southern California (table 1). These are the two communities that collectively are so commonly referred to as "brush." They typify the plant cover of the rugged mountainous areas to a far greater extent than any other kind of vegetation.

TABLE 1.—*Plant communities of southern California*

Plant community	*Area (acres)*
Forest:	
Commercial	341,000
Noncommercial	1,016,000
Woodland-grass and woodland	843,000
Woodland-grass and woodland	653,000
Grassland	843,000
Brush:	
Chaparral	3,850,000
Sagebrush	1,431,000
Desert and barren	15,697,000
Cultivated, urban, and industrial	2,422,000+

Grasslands are still quite extensive, occupying some 843,000 acres. Areas where the plant cover is dominated by woodland-grass or woodland cover some 653,000 acres. Forests that are productive of commercial timber occur on only 341,000 acres of this land, but are important for homesites and recreation far out of proportion to the area occupied.

Great changes have been wrought in the natural vegetation by man's occupance of this region. Today in the neighborhood of 3 million acres are classed as cultivated, urban, and industrial lands. Even where the land has not been used for agriculture, or for urban and industrial development, it shows effects of grazing, fire, and other disturbances that have accompanied settlement and use by man.

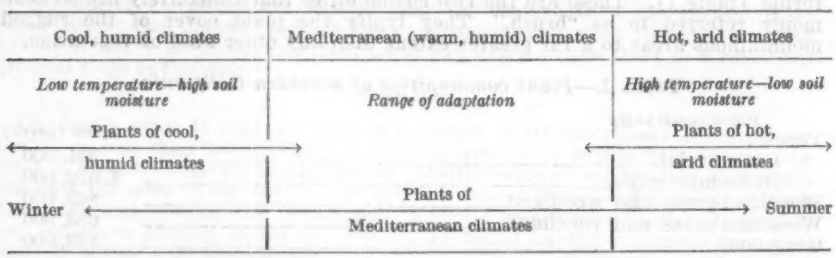
Ownership of these wild lands is divided almost equally among private individuals and corporations, and a multitude of local, county, State, and Federal agencies. Holdings in the various ownerships are widely scattered, the intricately intermingled pattern immensely complicating development and application of suitable land management measures.

Interrelationships between vegetation and management problems

The major problems in management of these wild lands are centered in maintaining a protective cover of vegetation on the relatively unstable soils, and in preventing destruction of that cover by fire. Both these problems are intimately related to the physical environment of the region. The brush—chaparral and sagebrush—and the woodland-grass are the two really important plant communities in this respect, so our attention will be centered upon them.

Only plants which are fully adapted to meet the peculiar demands placed upon them by such an environment can grow successfully in a Mediterranean climate. And these demands seldom have been fully appreciated. In most regions of the earth, plants will grow successfully and maintain a vegetative cover on the land if they are adapted to meet only one set of adverse conditions during their life cycle. For example, plants growing in deserts must withstand the rigors of high temperatures and drought characteristic of such locations. Plants of cool, humid climates are adapted to growth during periods of high rainfall and low temperature, and must be able to resist cold or freezing weather. Only in regions of Mediterranean climates must plants be adapted to survive both these extremes of environment—not once, or occasionally, but every year. The range of adaptation to environment for plants growing in Mediterranean climates must be nearly as great as the combined range of desert plants and cool, humid climate plants (sketch). In these regions temperatures may average only a little above freezing for 2 or 3 months of the year. Soil moisture commonly is at or near saturation levels during much of this time, and plant roots are very poorly aerated. To survive in this environment, plants must be able to germinate

and make appreciable amounts of growth during this period of the year when there is an adequate supply of water. During summer the situation is reversed—temperatures, of both air and soil, reach unusually high levels; soil moisture is reduced near or to the wilting point. Plants must be adapted to survive under such desiccating conditions either through achieving dormancy or by production of seed.



These environmental conditions favor growth of shrubby plants that can go into a state of dormancy and use essentially no water during the period of summer drought, or short-lived herbaceous species that can germinate and grow rapidly during fall and winter when temperatures are low and soil moisture is near saturation levels, and produce seed with the onset of drought. These rigorous requirements which this Mediterranean environment places upon plants largely explains why the dominant vegetation of our southern California mountains is chaparral or sagebrush and their associated herbaceous species. They explain why the first Spanish expedition to traverse this region in 1769—and many, many others that followed them—found the country covered with "* * * brush and low woods, which delayed us for a long time, making it necessary to cut the brush down at every step that was taken."

The natural vegetation of these lands, having developed under the stresses of this environment, is admirably adapted to survival in this habitat. These facts explain its persistence, and the difficulties of replacing the native plants with introduced species, by any means short of intensive cultural treatment.

During the past several years some efforts have been made in this direction by ranchers in southern California who have been interested in improving chaparral-covered lands for range forage production. The volume of this work has not been large, and the majority of it has been done in San Diego County. Improvement work, largely through use of fire under controlled conditions, has been attempted on a total of nearly 28,000 acres since 1948. Success has been highly variable, but the ranchers concerned believe that these projects have considerable possibility when attempted on lands chosen with a view toward their fitness for forage production. However, prospects for range improvement here are far below the potential of brush-covered lands in the northern part of the State, where rainfall generally is higher and soils usually more productive and less subject to the hazards of accelerated erosion when their cover is disturbed.

Finally, the environment of a Mediterranean climate itself constitutes a most serious hazard to maintaining a plant cover in populated regions and in wild lands subject to a high degree of use. The threat of fire during the long dry season, when all vegetation is in an intense state of desiccation, frequently is extreme. The hazardous conditions are abetted by low humidity, strong winds, and intensive human use of these lands. During recent years, these conditions have been accentuated by vagaries of precipitation. In any region of low precipitation, such as we are dealing with here, significantly more than half of the seasons will receive less than the average rainfall, the fraction increasing as mean precipitation decreases. At San Diego, for example, where records of precipitation have been maintained for 107 years, less than normal rainfall is received in approximately 7 seasons out of every 10. When the number of these seasons of deficient precipitation occur consecutively—as has been the case for the past several years—there may be an increased dieback of the chaparral vegetation, which adds immeasurably to the already large volumes of highly flammable fuel of the wild lands.

With this physical setting clearly in mind, together with the conditions and limitations it imposes, we can proceed to a consideration of the resource values at stake and the problems of their protection from fire.

Resource Values

The chief importance of the mountainous areas of southern California is in connection with water production and flood control. While certain other values are definitely important, they just as certainly are secondary in character. Recreational and homesite use, wildlife habitat, timber production, and range use all constitute secondary values of these wild lands, and, in some respects, they are highly significant aspects of management.

The annual recreational use of this area has been estimated to exceed 13 million man-days. Some 353 public recreational areas are maintained by national forests, State division of beaches and parks, and county agencies. Some 206 different organized group-camping areas, and more than 100 summer home and resort areas, are to be found within these wild lands.

A large proportion of these mountainous lands provide wildlife habitat that is highly important from both the recreational standpoint, for hunting and fishing, and for the preservation of rare species. Fifty-eight lakes and nearly 800 miles of streams are available to fishermen during the season; many of these areas have been improved to provide year-round sport. Nearly 5.3 million acres are available to hunters; habitat-improvement projects and other measures constantly are adding to this area and increasing its value.

The stands of commercial timber that are found at higher elevations in the mountains produce some 23 million board-feet of lumber and other forest products annually. Approximately on-half million animal units of range cattle and sheep are located in the seven counties of southern California; a considerable proportion of these animals graze for varying periods of each year on the wild lands under consideration.

Water Production and Watershed Values

Paramount in any consideration of wild lands in southern California are their values for water production and as watershed. Approximately 7.3 million acres of rugged mountainous terrain, upon which the dominant plant cover is brush, with limited tracts of timber intermingled, produce supplies of water essential to those who dwell in the valleys below. These watersheds produce a total of approximately 35 percent of all water used in southern California; the proportion produced locally in the various counties ranges from about 50 percent in Orange to 100 percent in Santa Barbara and Ventura Counties.

Water produced from these watersheds is extremely important to the local economy of the region because of its low cost compared with transported water and the season of year at which it is available. Because it is generally agreed that lack of water will be the limiting factor in the future development of this region, it is highly important that these local sources be protected and maintained in the highest possible state of production.

Paradoxically, these mountain watersheds also are sources of disastrous floods that may cause enormous destruction of property and even loss of life. Such floods are more serious where lands have been denuded of their plant cover. Removal of the vegetative cover by fire normally results in higher peak flows of stream runoff and increased rates of soil erosion. Because of its function in promoting infiltration and reducing surface runoff and erosion, maintaining a plant cover is of first importance on watersheds of southern California.

State Fire-Protection Responsibility

Article 1, chapter 1, of division 4 of the Public Resources Code provides for a State fire-protection system.

These statutes describe the areas of the State in which it shall be primarily the responsibility of the State to finance a fire-protection system and therein to exercise is police powers to prevent and extinguish forest fires. The board of forestry is directed by statute to delineate these areas and to classify the lands for purposes of defining the intensity of fire-protection forces to be placed so that equality of protection can be afforded similar areas. They require the State forester to provide, in accordance with a plan approved by the State board of forestry, personnel, equipment, fire crews, fire lookouts, and facilities to prevent and extinguish forest fires, and to appoint forest officers to supervise the fire-fighting system. Authority to enter into contracts to obtain or provide fire protection for the described lands is also included.

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Areas to be classified as "State responsibility" are required to include:

(*a*) Forest lands (i. e., timberlands) (Clarke-McNary zone I).

(*b*) Areas which are the source of useful water where the vegetation prevents excessive soil erosion, retards water runoff, or accelerates water percolation (i. e., watershed lands) (Clarke-McNary zone I).

(*c*) Rangelands contiguous to the foregoing two classes of land (State zone II).

Areas excluded from primary State responsibility are Federal lands, lands in incorporated cities, and lands not classified as timber, watershed, or contiguous rangelands. Such lands are the fire-protection responsibility of local government or Federal agencies, as the case may be.

THE FIRE-PROTECTION SYSTEM

The operation of a fire-protection system on suburban, rural, and wild-land areas of California is very complex because of intermingled types of areas and kinds of responsibilities (including intermingled forest and structural fire problems) and because of the intermingled of Federal, State, and privately owned lands. However, through contractual agreements and harmonious working relationships with the various local and governmental agencies concerned, a system has been developed which provides protection to the several areas of responsibility with a minimum of duplication of effort and expense. This system is briefly described in the following paragraphs.

(*a*) *Federal responsibility lands*

The United States Forest Service, at Federal expense, provides forest-fire protection on federally owned lands within the national forests. Some Federal lands along the boundaries of the national forests are contracted to the State for fire protection. Also, the State forester contracts with the United States Forest Service for them to provide fire protection, on 5,578,000 acres of "State responsibility" lands within the national forests (i. e., State and privately owned timber and watershed lands).

The National Park Service provides fire protection in the several national parks and monuments within the State.

The military agencies are responsible for fire protection, as needed, on military reservations.

Fire protection on other federally owned timber and watershed lands, being intermingled with "State responsibility" lands, is generally provided by the States (in some instances by counties) under contract with the appropriate Federal agency.

(*b*) *Local responsibility lands*

Outside of incorporated cities, on lands which have not been classified by law as timber, watershed, or contiguous rangelands, local agencies are responsible for fire protection. In some areas, this protection is provided by local or county-wide fire districts; in other areas, by county fire departments. However, in 30 counties the State forester, at the request of the local government, contracts to provide this rural fire-protection system at county or fire-district expense.

(*c*) *State responsibility areas*

The areas in which the State has primary responsibility for maintaining the fire-protection system are divided into three categories:

(1) *Areas in which the division of forestry provides fire protection directly.*—This consists of 22,800,000 acres of timber, watershed, and range lands lying generally outside the boundaries of the national forests. It includes about 2 million acres of intermingled Federal lands protected under contract with Federal agencies. The division's organization for administering its activities in this area is divided into six districts, with headquarters at Santa Rosa, Redding, North Sacramento, Fresno, Monterey, and Riverside. In these 6 districts are 30 ranger units, through which is provided local administration and supervision of fire-prevention and fire-suppression activities, consisting of some 225 fire crews, 80 fire lookouts, fire-prevention patrolmen, the operation of specialized fire-fighting equipment, and numerous citizen volunteer fire-fighting groups.

(2) *State and private lands in national-forest boundaries.*—These consist of 5,578,000 acres, mostly of private lands. These lands are presently afforded fire protection by the United States Forest Service, as noted in (*a*) above.

(3) *State-responsibility lands in "contract" counties.*—These consist of 3,209,000 acres of timber, watershed, and range lands in 6 counties which have elected, as provided by law, to provide forest-fire protection on State-responsibility areas. These counties are Marin, San Mateo, Santa Barbara, Kern, Ventura, and Los Angeles. The fire protection hereby afforded is integrated with a countywide fire-protection system in the rural areas of each county.

With the exception of Kern County, these counties had maintained forest-fire protection systems before the State system was well established. The legislature annually appropriates funds to the State forester for the support of the forest-fire crew organization in these counties. This appropriation partially reimburses the counties concerned for the cost of fire protection in such State-responsibility areas.

PROBLEMS AND SOLUTIONS

A. General

The State-responsibility areas encompass about one-half the water-producing land in California and one-half of its timber-producing areas. Maintenance of a cover of timber and other vegetation on these areas is vital to the economy of the State because of increasing values of the timber resource (the timber industry employs 10 percent of those engaged in manufacturing in California, second highest lumber production in the Nation), and because of the role played by vegetation in protecting streams and reservoirs from siltation with resultant pollution of water, reduction in storage capacity and cost of channel clearance, levee repairs, etc. While other factors of land use affect the result, protection from uncontrolled fire is a primary necessity. The average annual occurrence of fires on these lands exceeds 3,000 in number, which burn an average of 190,000 acres per year.

The objective of the State's fire plan is to provide basic fire protection to all areas of State responsibility.

"Basic fire protection," as defined for the purpose of this plan, is that level of intensity of fire protection which will, through the application of properly integrated fire-prevention, presuppression, and fire-control efforts, hold the fire damage below the level at which it would seriously interfere with the expected yield of products and of social benefits from these lands.

"Basic fire protection" envisions an organization capable of reducing the occurrence of preventable fires to an acceptable minimum and providing satisfactory forest fire control (i. e. control during first burning period) under average bad fire danger conditions. It does not envision preventing all man-caused fires, nor providing absolute maximum fire protection with all possible refinements of fire-control operations, but rather a basic organization supplemented by the planned use of available cooperative forces. Its strength comes not from having maximum forces in every area but in its ability to expand rapidly and from its statewide flexibility of operation which enables it to successfully meet emergency fire situations.

Such an organization must have an adequate supervisory staff, a trained complement of crew leaders and equipment operators, mobility of personnel, adequate communication, fire-control equipment, and transportation facilities to achieve the foregoing objectives.

In planning this basic fire-protection organization, the Division of Forestry recognizes that population concentrations in mountain areas, intermingled with forest vegetation, have made the forest fire problem more complex by removing the advantages of selecting time and place of action in fire-control operations. Therefore, the Division plans to meet this more complex watershed, timber, and range fire problem through strengthened fire prevention, presuppression, and fire control means.

FIRE PROTECTION RESPONSIBILITIES IN SOUTHERN CALIFORNIA

The foregoing statements concerning statutory responsibilities, the general protection system and objectives, while of a statewide nature, are equally applicable to the southern California area. To fully visualize all facets of the protection problem in southern California, however, it is necessary to detail out more specific data on this latter area.

The State of California is responsible for the protection of the following acreages in the seven counties commonly referred to as southern California.

TABLE I.—*Statutory and contract protection acreages, California Division of Forestry*

	Statutory responsibility, State and private				Direct protection, statutory and contract responsibility			
	Zone I		Zone II, outside national forests	Total State responsibility	Zones I and II		Total	Zone III, rural
	Inside national forests	Outside national forests			State and private [1]	Federal [2]		
Santa Barbara	72,815	296,960	251,300	621,075	(2)	(2)	(2)	(2)
Ventura	49,043	240,040	71,760	360,843	(2)	(2)	(2)	(2)
Los Angeles	42,749	277,505	204,004	524,258	(2)	(2)	(2)	(2)
Orange	14,170	100,400	69,875	184,445	170,275	200	170,475	221,000
Riverside	106,655	368,360	98,326	573,341	467,606	136,083	603,689	799,000
San Bernardino	112,564	102,890	153,298	368,752	256,218	71,272	327,490	588,000
San Diego	134,136	600,274	237,647	972,059	837,769	283,420	1,121,189	425,000
Total	532,132			3,604,773				

[1] Excludes water, desert, and incorporated areas.
[2] Protected by counties through contract with the State.

CONTRACT COUNTY PROTECTION

In southern California the counties of Santa Barbara, Ventura, and Los Angeles maintained forest-fire protection systems before the State system was well established. They act as an agent of the State forester in the protection of those State responsibility lands situated outside the national forest boundaries and outside incorporated cities. The State legislature annually appropriates funds to the State forester for the support of the forest-fire crew organization in these counties.

This appropriation partially reimburses the counties concerned for their cost of fire protection in such State responsibility area.

The combined zones I and II acreage of State responsibility lands falling within this category are as follows:

TABLE II.—*Contract county protection—zones I and II*

County:	*Acres*
Los Angeles	481,509
Ventura	311,800
Santa Barbara	548,260
Total	1,341,569

PROTECTION OF STATE AND PRIVATE LANDS WITHIN THE NATIONAL FORESTS

The areas of State and private lands (all classified as zone I) falling within the national forest boundaries are tabulated by counties in table I above. The acreages of these lands are also shown below by national forests. Since the Los Padres National Forest includes parts of counties other than Santa Barbara and Ventura, this latter total slightly exceeds the total shown by counties.

TABLE III.—*Acreages of State responsibility lands within national forests*

National forests	Gross acreage	State responsibility acreage
Los Padres	2,041,185	259,523
Angeles	691,052	42,778
San Bernardino	811,964	197,149
Cleveland	659,553	177,991
Total	4,113,754	677,441

As pointed out in the discussion of the State fire-protection system, small blocks of State or private land commingled with national forest land make it

more practical for the State forester to contract with the United States Forest Service to provide protection for these State-responsibility lands. The protection needs on the private lands inside the national forests were established in the State fire plan. The State legislature appropriates funds which, in accordance with the fire plan, should, if applied on the same basis, provide the same level of fire protection on these lands as for similar areas which are under the direct protection of the State forester's organization. Unless the national forest forces for protection of Federal lands are equivalent, the State funded forces will tend to be dissipated over the combined Federal-State fire problem. The plan proposed that crews, lookouts, and patrolmen be established on the four southern forests at locations which will provide initial attack fire suppression action for the protection of the net private land acres within the boundaries of the national forests. The net acres are arrived at by deducting the national forest acreages protected by the State (isolated areas outside of the pay protection boundary) from the gross acreage of State and private lands inside, or above. the pay protection boundary.

TABLE IV.—*1956 fire plan*

National Forest	Number of crews	Size No.	Lookouts	Patrolmen
Angeles	2	1		1
Cleveland	1	3		1
Los Padres	2	1	1	1
	1	3		
San Bernardino	2	1	1	1
	1	4		
	1	5		

The above crew sizes represent the following equipment and personnel manning strength.

TABLE V.—*Crew composition*

Unit	Fire trucks	Foremen	Drivers	Fire fighters
No. 1	1	1.5	1	3
No. 3	2	1.5	2	7
No. 4	2	1.5	2	9
No. 5	2	1.5	2	11

Foremen and drivers are provided for the entire fire season period; the number of fire fighters shown in the above table are the anticipated number hired at the peak of the fire season period. While the actual allotment for the 1957–58 fiscal year is slightly below the 1956 proposed plan, the reduction is in line with legislative authorization, and is in proportion to that authorization as it affects the State crews in both the State protected area and in the contract counties.

It must be recognized that both crews paid for by State funds and the United States Forest Service crews may protect both private and Federal lands within their area of operation. Protection coverage of these crews inside the national forest boundaries is determined on an "offset" basis.

PROTECTION OF LANDS ADJACENT TO THE NATIONAL FORESTS

Protection of the State and private lands by the "contract" counties has been mentioned in A, above. In the other four southern California counties of Orange, Riverside, San Bernardino, and San Diego, California Division of Forestry organizations are established. These State forestry units protect those wildland areas of intermingled ownership which, for the most part lie below the national forest boundary elevations.

A discussion of the State forester's organization and fire load is pertinent to this hearing because: (1) Fires starting in zones I and II of the State protected area, if not promptly controlled, would normally spread rapidly upward onto national forest lands, and (2) a fire-fighting force of this nature is a valuable ally which can be requested upon a mutual aid or hire basis to help control fires starting inside the forest boundaries, and, in fact, does promptly take action on many fires inside national forests.

1. The State protection force (1957–58 fiscal year) (southern California only)

(*a*) Man-months of fire control personnel	3,177
(*b*) Fire patrolmen	12
(*c*) Number of administrative fire-control personnel	43
(*d*) Number of fire stations	43
(*e*) Number of fire trucks	66
(*f*) Pickups and pickup pumpers	35
(*g*) Bulldozers	6
(*h*) Transports	6
(*i*) Lookouts	9
(*j*) Phoneline (miles)	200
(*k*) Roads and truck trails (miles)	625
(*l*) Firebreaks (miles)	110

2. Supporting organization

(*a*) Range and forest technicians, clerical help, equipment mechanics, storekeepers, engineers, fire-prevention and law-enforcement personnel, etc	22
(*b*) Graders, equipment service units, dump trucks, fuel trailers, stakeside trucks, etc	94

TABLE VI.—*The annual State fire load, 5-year average, district VI (1951–55)*

Forest fires in zones I–II		Forest fires in zone III	Zone I–II, nonforest	U. S. Forest Service fires	Miscellaneous fires
Schedule A [1] crew runs	Schedule B [2] crew runs				
104	662	1,290	309	123	97.

[1] Schedule A (crews supported from county funds—see rural protection, below).
[2] Schedule B (crews supported by State funds).

Fire prevention efforts by the California Division of Forestry in southern California concentrate on reaching the mass public through radio, television, newspapers, and fair displays. This approach is partially necessitated by the large populations living and working in the State protection area. In the more outlying areas personal contact is practiced.

The 1956 fire plan provides for the establishment of a training center in San Diego County. This type of facility is aimed at providing more intensive and uniform training to all CDF personnel in district VI than has heretofore been possible. In order to put the fire control and prevention training on a more professional basis, in recognition of the difficult and hazardous fire control conditions the firemen must meet.

INMATE WORK CAMPS

In addition to the regular CDF fire-control forces, there are four forestry work camps located in southern California. These camps, jointly operated by the Division of Forestry and the California Department of Corrections, each house 60 adult inmates who are available for phoneline, road, firebreak, and similar forestry construction projects. They are trained in fire suppression techniques by our field personnel and are frequently used during the summer to help control fires; 114,928 man-hours were expended by these inmates on California Division of Forestry and United States Forest Service fires in 1956. The major fuel breaks cleared by these crews in the "front country" are of utmost importance to the national forests. Two additional camps are authorized for development, and the force available by 1960 will be 400 men.

PROTECTION OF LOCAL-RESPONSIBILITY LANDS

The rural areas of San Diego, Orange, Riverside, and San Bernardino, which cannot be classified as either primary or secondary watershed, are termed zone III and, where not within incorporated cities or fire districts, are protected by the division of forestry organization through contract with the counties (Fire districts may upon occasion also be protected by CDF). The crews and

administrative personnel assigned to this protection job are of importance to both the State responsibility fire load as well as the United States Forest Service interests. Fires starting in these rural areas may spread, if not suppressed, onto either State protected lands or onto the national forests. The latter possibility can occur either by fires moving through zones II and/or I of the State area, or by spreading directly from zone III areas, which in some instances are adjacent to the national forest boundary.

Each of these counties support large forces operated by the division of forestry. The 1957–58 combined budget totals $1,230,100. While the majority of these funds are spent on zone III protection, some is specifically authorized for augumentation of the zone I–II job in the State responsibility areas. These forces, through integration with the whole State fire force, materially augment national forest protection forces.

NEW FRONTIERS IN FIRE CONTROL

The division of forestry recognizes that to increase fire-suppression effectiveness in southern California, will require additions to and improvements of present fire-control techniques.

From fire prevention to training, pre-fire-control planning, dispatch, initial attack, and campaign fire strategy, constant search must be aggressively pursued in an attempt to increase efficiency. Ever-expanding populations and ever-higher resource values work together in creating complex relationships which in turn confront all fire agencies who must meet a daily fire threat.

A. Equipment development

The division of forestry has, for many years, maintained a force of equipment engineers. These men, teaming with experienced field personnel, have designed increasingly efficient fire trucks, tiltbed transports, and trailers, and specialized equipment such as backfire hose-lay trailers, fire plows, hydraulic and electric dozer blade controls, electric powered slip-on fire pumps, mobile field kitchens, silver iodide generators, tanks for use in aerial water and chemical drops, canvas slip-on tanks and pumps for auxiliary use on dump trucks and transports, etc. Much of this equipment has been designed for use in specific problem areas. For instance, because of topographic and vegetative differences, six basic designs have been developed for fire trucks needed throughout the State.

B. Other research

1. Economics of fire protection: a special 3- to 5-year study of the kind and magnitude of economic values protected by the fire-control system, of the effects of different levels of protection on these values and a comparison of the costs of the alternative levels of protection.

2. Fire-prevention questionnaire survey: A survey to determine what the citizen knows about fire prevention and fire hazards, where they learned their information, and what types of prevention action are most effective in preventing man-caused fires.

3. Lightning control: Operational studies have been in process since 1954 on cloud-seeding techniques. Currently both ground generators and airborne generators are being utilized in two test areas for evaluation purposes.

4. Fire climate studies: A cooperative project between the California Forest and Range Experiment Station and the California Division of Forestry designed to collect information on local weather conditions.

5. Fire weather index: This cooperative project has produced an index correlated with weather; further correlation is needed to tie the present index to fuel types and topography so as to produce a fire danger rating system.

6. Hazard reduction in southern California: district VI, of the Division of Forestry has, for some time, been heavily engaged in a program entitled "Operation Prefire Control." This operation is intended to develop fire or fuel-breaks, roads, heliports, water developments, etc., to facilitate fire-control operations. The fuel-breaks are barriers which will provide access to fires and aid in stopping major conflagrations moving rapidly through the brush-fuel types of southern California. This program is now being coordinated with "Operation Fuelbreak" of California Forest and Range Experiment Station to further facilitate the reduction of the extreme fire hazards created by large expanses of brushland will involve hand and mechanical treatment, chemical spraying, ecological and genetic studies, substitution of species, etc.

7. Evaluation of fire-control methods: This is a proposed project to be coordinated with that of the California Forest and Range Experiment Station which has been termed "Operations Research." It will be primarily an evaluation of dispatch and initial attack methods used by fire forces in an effort to determine what techniques are most effective under specified conditions.

With the sincere cooperation of the public and all fire agencies, experience and research properly applied will result in favorable fire-control progress. Basic fire protection continues to be the objective of the State forester and his organization, and it is acknowledged that in order to reach and maintain such an objective, constant progress is required.

The CHAIRMAN. Thank you very much, Mr. Raymond, for that excellent statement. If you will remain on hand, we will get around to questioning after we hear from the others.

The next witness is Mr. DeWitt Nelson, director of the California Department of Natural Resources. He is also president of the Society of American Foresters, and chairman of the committee on land ownership study created by the American Forestry Association, and also a former forest supervisor for the United States Forest Service.

Is that right?

Mr. NELSON. That is right.

The CHAIRMAN. You have been pretty well around, Mr. Nelson. We will be glad to have your statement. Can you summarize it?

Mr. NELSON. I think so.

The CHAIRMAN. You may proceed.

STATEMENT OF DeWITT NELSON, DIRECTOR, CALIFORNIA DEPARTMENT OF NATURAL RESOURCES, SACRAMENTO, CALIF.

Mr. NELSON. Mr. Chairman and gentlemen of the committee, we in California appreciate the interest expressed by your committee in the protection of the forest, watershed, and range resources of this State. The basic emonomy of California depends upon these and their related resources of soil, water, forests, forage, minerals, wildlife, and recreational opportunities.

California's executive, legislature, and county governments have long recognized the vital necessity of protecting these resources from fire—not only to protect a growing resource but to protect the agricultural, urban, and industrial improvements from subsequent flood and debris fows and to minimize the siltation of river channels, reservoirs, and water-spreading grounds.

The management and manipulation of watershed brush cover to simplify protection and maximize water yield—particularly in southern California—is yet one of our unsolved problems. This is an area in which local, State, and Federal agencies are working cooperatively in search of solutions through research and field experimentation.

Of California's 100 million acres, 47 million acres are in Federal ownership. These lands and their resources form an important and integral part of California and its economy. We are as vitally concerned with the protection and management of these federally managed lands and resources as those belonging to the State and its citizens. In redeeming these mutual responsibilities we enjoy cordial cooperative working relationships with every Federal agency having a similar responsibility.

This spirit of cooperation is most strongly exemplified in the field of fire protection and fire research. Here is demonstrated a spirit of

competitive teamwork that is unsurpassed, and I doubt if it is matched anywhere in the Nation.

Since Francis Raymond, State forester, has given you in considerable detail the fire protection and cooperative programs and procedures of the State, I will not dwell longer on that subject, Mr. Chairman. However, in your invitation, Mr. Chairman, you asked that, as chairman of the American Forestry Association's committee on landownership study, that I give you a brief report on that subject.

I am happy to do this, but, first, I must give you a brief background statement.

In 1953 the American Forestry Association held a Forest Congress in Washington, D. C., to suggest a forest and wildlife program for the future. From that congress came several recommendations in regard to management and resource problems on private, State, and Federal holdings.

As an example, one recommendation was the clarification of the surface resources from the underground resources on mining claims. The association worked with the mineral industries and the Departments of Interior and Agriculture on this program. As a result of this and additional work by your committee, Public Law 167 was enacted.

The subject of forest-land ownership, particularly public lands, was recommended for study by a joint congressional committee. In the meantime, the association appointed a committee of its own with which it hopes to make sample studies and reports on three States having different land-pattern histories, such as one State in the West, one in the Lake States, and probably one in the South. The undersigned is currently chairman of this committee.

We are fortunate in securing a grant for the financing of such a study in California. The grant was made available by Mr. Carl F. Rehnborg, president of the Nutrilite Foundation. Dr. Samuel T. Dana, dean emeritus, School of Natural Resources, University of Michigan, headed the study. It is now being prepared for publication in book form.

In making this study we found that we could not separate public ownership from private ownership, nor could we separate ownership from management. Ownership is a "means to an end" and "ownership controls management." We also found that we could not separate purely forest landownership and its problems from other resource lands and their problems. Therefore, this report covers the broad subject of those lands other than urban and cultivated lands.

The published report will be titled "California Lands—Ownership, Use, and Management."

It presents factual data and information on history, present patterns of ownership and management, identifies problems, and suggests some solutions, frequently by raising questions. In addition, the report makes one firm recommendation, that the State legislature create a natural-resources council consisting of representatives of State and Federal agencies, private interests and citizens, to continuously study the related and overlapping problems of land and resource ownership, use, and management, for the purpose of identifying, coordinating, and correcting problems when and as such can be accomplished.

In order that you might better appreciate the scope and nature of the report, I present the attached highlights from California Lands—Ownership, Use, and Management.

I will read to you the highlights from this report, and I think it is more or less pertinent to the subject under discussion, the protection and management of our resource lands. The highlights of this report are as follows:

People: In a century, California has become the second most populous State in the Union. In a few years it will be at the top. Today, birth and immigration bring it a new resident every 55 seconds. No limit to the increase is yet in sight.

California's people are not only numerous—they are industrious and productive. Among the States in the Nation, California is first in cash farm income, second in the production of lumber, third—and most diversified—in value of mineral production. In the 8 years 1947 to 1955 its gain in manufacturing employment was 13 percent greater than in New York, Pennsylvania, Ohio, Indiana, Michigan, Illinois, and Texas combined.

Land: Wherever people live, whatever they do, they are inescapably dependent on natural resources—land, water, and their products. California's size—100,314,000 acres—is second only to Texas. This is a vast area. It is also a fixed area. Within limits, however, its yield of food and services can be increased or decreased.

These 100 million acres vary widely in character. The chief value of more than one-third is for forest and watershed purposes. About a fifth is barren and desert land. Only a sixth is suitable for cultivation. Scenic and recreational resources—beaches, forests, lakes, mountains and wildlife—are outstanding. Water is abundant; its distribution, seasonally and geographically, constitutes the problem. The solution requires engineering, economic and political adjustments of major magnitude.

Ownership: When California entered the Union, title to its entire land area was vested in the United States with the exception of some 8,850,000 acres in Spanish and Mexican grants. Congress has since disposed of 46,500,000 acres in grants to the State and to railroad corporations and by sales and grants to individuals. The State and railroads, in turn, disposed of much of the area granted them.

Since 1890, when three national parks were established in California, reservation and withdrawal of public lands from entry have become increasingly characteristic of Federal land policy. The State still owns nearly a million acres of school-grant lands. Both Federal and State Governments have acquired limited amounts of land by purchase and exchange.

Today, California lands are almost equally divided between public and private ownership. Some 47 million acres are in Federal ownership, some 2 million acres in State ownership, and somewhat more than 51 million acres in private ownership. Unreserved public domain, including grazing districts, national forests, and military installations comprise the bulk of the area in Federal ownership. State beaches and parks, school-grant lands and tax-deeded lands are the major forms of State ownership. Of the privately owned land, nearly 38 million acres are in farm and ranch ownership and about 6.5 million acres in commercial forest land not in farms.

Management: Exploitation characterized the early use of California's lands. Natural resources—soil, water, timber, forage, wildlife and minerals—were thought inexhaustible. So, why be thrifty in their use?

Changes in attitude and practices first appeared in agriculture. Production of irrigated crops led to more intensive management. The upsurge of the conservation movement in the early 1900's led to the planned, although at first not intensive, management of the resources in national forests. Improved management of the resources in national parks, wildlife refuges, and grazing districts followed.

State acquisition of parks, wildlife areas and State forests resulted in placing them under management. The State also enacted legislation aimed at promoting the conservation of oil and gas resources in private ownership and the improved management of private timberlands.

A conspicuous recent change in the situation has been the new attitude toward management evidenced by many private owners, particularly the larger owners, of forest and range resources. The growing demand for these resources, increased values, and improved technologies of production and utilization have made management profitable.

Problems: California faces an inescapable problem which is rapidly becoming more acute. How can its limited natural resources meet the needs of a skyrocketing population? This one central problem involves innumerable interrelated problems.

Lands outside of farms yield a wide variety of products and services. Of these, water is universally given top priority. But ample timber, forage, wildlife and opportunities for recreation, including the preservation of some unspoiled wilderness are indispensable elements in modern civilization. Multiple use is commonly regarded as a cornucopia from which will flow unlimited supplies of everthing we need, with little appreciation of its limitations.

Not all uses are compatible. Even with compatible uses, as we increase the yield of one product or service, we often decrease the yield of others. In some places, if we want more water, we may have to grow less timber. Ownership of land resources controls their management. It is, therefore, essential to know what results may be expected from different forms of public and private ownership. But results can be evaluated only by comparing costs and returns, direct and indirect, tangible and intangible. Such comparisons pose problems for the study of which we do not yet have reliable techniques. A simpler but highly important task is to determine the influence of intermingled ownerships on the intensity of management, and to effect the blocking up of ownerships where this seems desirable. Public ownership raises difficult questions as to financial responsibility of the public owner to the local community.

What next?

The first step in solving the many problems of natural-resource management is for all owners to make more effective use of the information already available. In general, knowledge is far ahead of practice. The next step is to conduct the studies necessary to expand existing knowledge as to the ownership patterns, management techniques and public policies that will give the most satisfactory results from the standpoint both of the owners and the general public.

Three things are certain: 1, that far more intensive resource management by all classes of owners will be essential to close the prospective gap between needs and supplies; 2, that such management is dependent on increased and continuous study; and 3, that the results must find practical application.

The fact that all resource problems are interrelated points to the need for some device by which the combined efforts of the landowners and managers, both public and private, and of the general public can be mobilized to seek their solution. The most promising approach to this goal is the creation by the legislature of a natural resources council consisting of qualified representatives of the State and Federal agencies, the private interests and the citizenry of the State. The duties of such a council should be:

1. To identify, stimulate, and coordinate studies of current problems connected with the ownership and management of natural resources;

2. To advise the legislature, the governor, and the various officers and interests represented in its membership with respect to natural resource problems, administration and management; and

3. To facilitate contacts and promote cooperation among the groups and interests represented in its membership.

The need for prompt action is urgent. California now has five more residents than when you started to read this statement. It has no more land.

Thank you, gentlemen. That is a brief résumé of the ownership report.

The CHAIRMAN. Thank you, Mr. Nelson. That is an excellent statement, and we are very happy to have it.

(Mr. Nelson's prepared statement follows:)

STATE OF CALIFORNIA,
DEPARTMENT OF NATURAL RESOURCES,
Sacramento, October 8, 1957.

Re hearing on forest fire protection, Los Angeles, Calif.

Hon. CLAIR ENGLE,
Chairman, Interior and Insular Affairs Committee,
Washington, D. C.:

We in California appreciate the interest expressed by your committee in the protection of the forest, watershed, and range resources of this State. The basic economy of California depends upon these and their related resources of soil, water, forests, forage, minerals, wildlife, and recreational opportunities.

California's executive, legislature, and county governments have long recognized the vital necessity of protecting these resources from fire—not only to protect a growing resource but to protect the agricultural, urban, and industrial improvements from subsequent flood and debris flows, and to minimize the siltation of river channels, reservoirs, and water spreading grounds.

The management and manipulation of watershed brush cover to simplify protection and maximize water yield (particularly in southern California) is yet one of our unsolved problems. This is an area in which local, State, and Federal agencies are working cooperatively in search of solutions through research and field experimentation.

Of California's 100 million acres, 47 million acres are in Federal ownership. These lands and their resources form an important and integral part of California and its economy. We are as vitally concerned with the protection and management of these federally managed lands and resources as those belonging to the State and its citizens. In redeeming these mutual responsibilities we enjoy cordial cooperative working relationships with every Federal agency having a similar responsibility.

This spirit of cooperation is most strongly exemplified in the field of fire protection and fire research. Here is demonstrated a spirit of competitive

teamwork that is unsurpassed, and I doubt if it is matched anywhere in the Nation.

Francis Raymond, State forester, will present California's program of fire protection and our cooperative programs and procedures. Therefore, I shall not dwell longer on this subject.

In your invitation, Mr. Chairman, you asked that, as chairman of the American Forestry Association's committee on the landownership study that I give you a brief report on that subject.

I am happy to do this but, first, I must give you a brief background statement:

In 1953 the American Forestry Association held a forest congress in Washington, D. C., to suggest a forest and wildland program for the future. This broad program envisioned action in many resource fields on private, State, and Federal holdings.

As an example, one recommendation was the clarification of the surface resources from the underground resources on mining claims. The association worked with the mineral industries and the Departments of Interior and Agriculture on this program. As a result of this and additional work by your committee, Public Law 167 was enacted.

The subject of forest landownership, particularly public lands, was recommended for study by a joint congressional committee. In the meantime, the association appointed a committee of its own with which it hopes to make sample studies and reports on 3 States having different land pattern histories—such as 1 State in the West, 1 in the East, and 1 in the South. The undersigned is currently chairman of this committee.

We were fortunate in securing a grant for the financing of such a study in California. The grant was made available by Mr. Carl F. Rehnborg, president of the Nutrilite Foundation. Dr. Samuel T. Dana, dean emeritus, School of Natural Resources, University of Michigan headed the study. It is now being prepared for publication in book form.

In making this study we found that we could not separate public ownership from private ownership, nor could we separate ownership from management. Ownership is a "means to an end" and "ownership controls management." We also found that we could not separate purely forest-land ownership and problems from other resource lands and problems. Therefore, this report covers the broad subject of those lands other than urban and cultivated lands.

The published report will be titled, "California Lands—Ownership, Use and Management."

It presents factual data and information on history, present patterns of ownership and management, identifies problems, and suggests some solutions—frequently by raising questions. In addition, the report makes one firm recommendation—that the State legislature create a natural resources council consisting of representatives of State and Federal agencies, private interests and citizens, to continuously study the related and overlapping problems of land and resource ownership, use, and management, for the purpose of identifying, coordinating, and correcting problems when and as such can be accomplished.

In order that you might better appreciate the scope and nature of the report I present the attached highlights from California Lands—Ownership, Use, and Management.

DEWITT NELSON, *Director.*

HIGHLIGHTS FROM CALIFORNIA LANDS—OWNERSHIP, USE, AND MANAGEMENT

(By the American Forestry Association's Land Ownership Study Committee, September 20, 1957)

PEOPLE

In a century, California has become the second most populous State in the Union. In a few years it will be at the top. Today, birth and immigration bring it a new resident every 55 seconds. No limit to the increase is yet in sight.

California's people are not only numerous—they are industrious and productive. Among the States in the Nation California is first in cash farm income; second in the production of lumber; and third (and most diversified) in value of mineral production. In the 8 years 1947–55 its gain in manufacturing employment was 13 percent greater than in New York, Pennsylvania, Ohio, Indiana, Michigan, Illinois, and Texas combined.

LAND

Wherever people live, whatever they do, they are inescapably dependent on natural resources: Land, water, and their products. California's size (100,314,000 acres) is second only to Texas. This is a vast area. It is also a fixed area. Within limits, however, its yield of food and services can be increased or decreased.

These 100 million acres vary widely in character. The chief value of more than one-third is for forest and watershed purposes. About a fifth is barren and desert land. Only a sixth is suitable for cultivation. Scenic and recreational resources—beaches, forests, lakes, mountains, and wildlife—are outstanding. Water is abundant; its distribution, seasonally and geographically, constitutes the problem. The solution requires engineering, economic, and political adjustments of major magnitude.

OWNERSHIP

When California entered the Union title to its entire land area was vested in the United States with the exception of some 8,850,000 acres in Spanish and Mexican grants. Congress has since disposed of 46,500,000 acres in grants to the State and to railroad corporations and by sales and grants to individuals. The State and railroads, in turn, disposed of much of the area granted them.

Since 1890, when 3 national parks were established in California, reservation and withdrawal of public lands from entry have become increasingly characteristic of Federal land policy. The State still owns nearly a million acres of school-grant lands. Both Federal and State governments have acquired limited amounts of land by purchase and exchange.

Today, California lands are almost equally divided between public and private ownership. Some 47 million acres are in Federal ownership some 2 million acres in State ownership, ald somewhat morethan 51 million acres in private ownership. Unreserved public domain (including grazing districts), national forests, and military installations comprise the bulk of the area in Federal ownership. State beaches and parks, school-grant lands, and tax-deeded lands are the major forms of State ownership. Of the privately owned land, nearly 38 million acres are in farm and ranch ownership and about 6.5 million acres in commercial forest land not in farms.

MANAGEMENT

Exploitation characterized the early use of California's lands. Natural resources: Soil, water, timber, forage, wildlife, and minerals were thought inexhaustible. So, why be thrifty in their use?

Changes in attitude and practices first appeared in agriculture. Production of irrigated crops led to more intensive management. The upsurge of the conservation movement in the early 1900's led to the planned, although at first not intensive, management of the resources in national forests. Improved management of the resources in national parks, wildlife refuges, and grazing districts followed.

State acquisition of parks, wildlife areas, and State forests resulted in placing them under management. The State also enacted legislation aimed at promoting the conservation of oil and gas resources in private ownership and the improved management of private timberlands.

A conspicuous recent change in the situation has been the new attitude toward management evidenced by many private owners (particularly the larger owners) of forest and range resources. The growing demand for these resources, increased values, and improved technologies of production and utilization have made management profitable.

PROBLEMS

California faces an inescapable problem which is rapidly becoming more acute. How can its limited natural resources meet the needs of a skyrocketing population? This one central problem involves innumerable interrelated problems.

Lands outside of farms yield a wide variety of products and services. Of these, water is universally given top priority. But ample timber, forage, wildlife, and opportunities for recreation, including the preservation of some unspoiled wilderness are indispensable elements in modern civilization. "Multiple use" is commonly regarded as a cornucopia from which will flow unlimited supplies of everything we need, with little appreciation of its limitations. Not all uses are compatible. Even with compatible uses, as we increase the yield of one product or service, we often decrease the yield of others. In some places if we want more water, we may have to grow less timber.

Ownership of land resources controls their management. It is, therefore, essential to know what results may be expected from different forms of public and private ownership. But results can be evaluated only by comparing costs and returns—direct and indirect, tangible and intangible. Such comparisons pose problems for the study of which we do not yet have reliable techniques. A simpler but highly important task is to determine the influence of intermingled ownerships on the intensity of management, and to effect the blocking up of ownerships where this seems desirable. Public ownership raises difficult questions as to financial responsibility of the public owner to the local community.

WHAT NEXT?

The first step in solving the many problems of natural-resource management is for all owners to make more effective use of the information already available. In general, knowledge is far ahead of practice. The next step is to conduct the studies necessary to expand existing knowledge as to the ownership patterns, management techniques, and public policies that will give the most satisfactory results from the standpoint both of the owners and the general public.

Three things are certain: (1) That far more intensive resource management by all classes of owners will be essential to close the prospective gap between needs and supplies, (2) that such management is dependent on increased and continuous study, and (3) that the results must find practical application.

The fact that all resource problems are interrelated points to the need for some device by which the combined efforts of the landowners and managers (both public and private) and of the general public can be mobilized to seek their solution. The most promising approach to this goal is the creation by the legislature of a Natural Resources Council consisting of qualified representatives of the State and Federal agencies, the private interests, and the citizenry of the State. The duties of such a council should be:

1. To identify, stimulate, and coordinate studies of current problems connected with the ownership and management of natural resources;

2. To advise the legislature, the governor, and the various officers and interests represented in its membership with respect to natural-resource problems, administration, and management; and

3. To facilitate contacts and promote cooperation among the groups and interests represented in its membership.

The need for prompt action is urgent. California now has five more residents than when you started to read this statement. It has no more land.

The CHAIRMAN. Now we will hear from Chief Engineer Keith E. Klinger, of the Los Angeles County Fire Department, who surprises a great many people who do not know the facts. He has one of the most effective and complete forest-fire and brush-fire fighting organizations in the country

Chief, we are very glad to have you here. I notice you get right down in the flatlands where the brush is, and have to fight fire sometimes right among the homes. We will be glad to have your statement. It is short enough to read.

Mr. KLINGER. I would rather go through it briefly than read it, if you do not mind.

The CHAIRMAN. That will be perfectly all right.

STATEMENT OF KEITH E. KLINGER, CHIEF ENGINEER, LOS ANGELES COUNTY FIRE DEPARTMENT

Mr. KLINGER. Naturally, I am here to try to show the side of Los Angeles County. I think Mr. Nelson, before, has shown you the growth of California, and I would like to show you some of the growth in Los Angeles County.

Los Angeles County is third in population in the United States. At the present time we have 5½ million people living in an area of 3,951 square miles. Of course, of this 3,951 square miles, the Angeles Forest comprises 27 percent.

We have an assessed valuation of approximately $10 billion.

Sixty percent of the water used comes off the watershed of Los Angeles County.

I would like to show you here, gentlemen, a map that will probably show you better than I can try to explain to you some of the problems we have here.

As you see here, this [indicating] is the Angeles National Forest in Los Angeles County. This [indicating] is the boundary line between Los Angeles and San Bernardino County.

This is the boundary between Ventura County. And up here is Kern County.

This [indicating] is the desert area in Los Angeles County.

All of this [indicating] mountainous area is protected by the United States Forest Service of Los Angeles County.

The yellow dots designate our fire stations that are operating on a year-long basis. The red dots are the ones we propose to build in the very near future. They are either under construction now or on the planning board.

As you can see here, the watershed along what we call the front country is declared the most valuable watershed in the United States. If you can imagine this, gentlemen, 98 percent of the 5½ million population reside in this area here, and only 2 percent out in the mountainous areas not affected by this watershed.

The cooperation between the two units, as Mr. Nelson told you, is something that is out of this world. I go all over the United States to various meetings, and it is unbelievable the cooperation we receive here from all the agencies—city, county, State, Federal Government, and the military.

The CHAIRMAN. Just to make this map clear, where are the boundaries of the Federal jurisdiction?

Mr. KLINGER. They are inside of this line [indicating], sir.

This is the Angeles National Forest here [indicating]. That is inside of Los Angeles County.

Of course, we have four national forests in southern California that are very valuable. They are the most valuable watershed in the country.

In our department we provide a yearlong fire protection, but the United States Forest Service at the present time are unable to provide this. They only provide about 8 months of the year. So, consequently, when the fire occurs within the Angeles National Forest it compels us—and actually we cannot do it; we do not have the foresters to fight those fires inside the national forest, because we are operating on a yearlong basis with no depletion in our operation.

At the present time our budget runs around $3 million for the protection of the watershed in the county.

Now the county of Los Angeles, in order to cooperate and work with the United States Forest Service and to carry out what we believe is our obligation, have built inside of the Angeles National Forest 63 water-storage units. Some of these water-storage units run up to as high as 19,000 gallons.

We have built 19 miles of trails, 32 miles of firebreaks, and have built 28 miles of motorways.

The motorways in Angeles National Forest at the present time are inadequate. We do not have the resources, the money, to go ahead

and build these motorways, and in my opinion that is one of the main reasons we are losing so many fires in the back country in the national forest area.

Back in 1953 and 1954, when we had what we call the Monrovia Peak fire, it started in an off season for the United States Forest Service. It was in this area here [indicating], with winds up to as high as 70 miles an hour driving the fire down into our very valuable watershed and getting into the homes around the various small cities that are built along the bottom of the foothills.

At that time, after the fire, the Los Angeles County Board of Supervisors started what they call the Los Angeles County Watershed Commission. This commission was provided by the county of Los Angeles to try and find out ways and means of providing better fire protection in the Angeles National Forest. At that time the members of this Los Angeles Watershed Commission made frequent trips to Washington to try and increase the funds to provide better fire protection.

At the same time the four national forests, the Los Padros, the Cleveland, the Angeles, and the San Bernardino, located in southern California, also had a citizens' group and they called themselves the Southern California Watershed Council. Now these people all work together under a plan provided by the United States Forest Service in what they believe to be the minimum to provide fire protection in the four national forests.

Up to now we have been very fortunate, I believe, in receiving about $900,000 in Federal funds additional over and above what they originally were allotted. We have in Los Angeles County cooperated with the United States Forest Service, the State, the various cities in providing fire research to find better ways and means of fighting these fires than we have here—helicopter operations, airplane operations.

And I might bring out, gentlemen, in a recent fire at Morris Dam up here, which I am sure Colonel Hedger will bring out, that if the rains come that we hope will come for the betterment of the watershed, the dam directly below this burn will be completely filled. I think Colonel Hedger will bring that out.

What I wanted to point out about this fire—the aerial waterdrop was one of the main sources of putting out this fire. It was something that, if you could have seen the operation, you just could not believe it. It actually stopped one of the main bodies of the fire.

So we believe that we have started something here which was started, Congressman Engle, in your part of the country by the crop dusters up there, the waterdrop, and it is something that is going to prove very valuable to us.

We have in the county three helicopters that are available. We do waterdrops. We lay hose with these helicopters, and they are proving very, very valuable.

I would, as a suggestion and something that we are looking forward to, say that is to see the day that the United States Forest Service can provide year-round fire protection in southern California. It is very essential. We cannot cope with the conditions we have here during the off season.

As you know, the Malibu fire—I am sure all of you are acquainted with that—started on December 26. The Monrovia fire started on

December 27. And it gets to be a pretty rough deal when you have no one to call on and back you up in conditions of this kind. And never in the history of the fire service has cooperation shown itself so well. Every agency in the State of California and the United States Forest Service was in there really working very hard and cooperating 100 percent.

Of course, we in Los Angeles County would like to see more moneys allowed for more firebreaks, more motorways, more personnel, more apparatus, and on a yearlong basis.

I know that I have skipped around here a little bit, but I think that my statement will show you very, very close to what I am sure you are looking for. If there are any questions, I think we will be down here answering them for you, and I appreciate the opportunity of appearing.

(Mr. Klinger's statement follows:)

STATEMENT OF K. E. KLINGER, LOS ANGELES COUNTY FORESTER AND FIRE WARDEN AND CHIEF ENGINEER, FIRE PROTECTION DISTRICTS

I. LOS ANGELES COUNTY

Los Angeles County is the third largest population center in the United States. Excluding county area on Catalina and San Clemente Islands, the mainland area is 3,951 square miles encompassing 60 incorporated cities, numerous large county unincorporated communities, and large areas of wildlands. This figure includes 1,079 square miles in the Angeles National Forest or approximately 27 percent of the county, of which 96 percent is federally owned with the remaining 4 percent privately owned lands within the boundaries of the Angeles National Forest.

The population of Los Angeles County as of July 1, 1957, was 5,507,429 with an assessed valuation of $9,846,084,700. Approximately 5,426,324 people, or 98 percent of the entire population, are compressed into 880 square miles or about 20 percent of the entire mainland area. This population is in the main adjacent to but south of the Angeles National Forest and is located principally in the Los Angeles coastal basin, San Fernando, and the San Gabriel Valleys. Conservative estimates show a yearly increase of 200,000 people over the past 7 years with a forecast of 9 million people by 1975 for Los Angeles County. This is a phenomenal growth which has strained and is now diminishing the natural resources, principally water, of the county both within the Angeles National Forest and areas outside.

For the above population and assessed valuation, 60 percent of all water now used in Los Angeles County is "native water," i. e., water secured from its own natural watersheds both within and outside the Angeles National Forest. The remaining 40 percent of water consumed is imported from many miles away and outside the county through costly manmade works. The major portion of this imported water is stored in open reservoirs. Much of it is also allowed to percolate down streams and channels to natural underground storage basins. Both the reservoirs and percolation areas are subject to general deterioration from erosion and debris resulting from burned-over areas within the tributary watersheds. Here again is the vital need to preserve and maintain the natural vegetative growth of the watersheds.

Los Angeles County's social and economic structure is basically dependent on water which in turn requires the highest level of watershed fire prevention and control, together with proper management and utilization. This is not only my official position, but it is also my deep-seated and sincere personal conviction based not only on the Los Angeles County areas but on simlar problems throughout California and specifically in southern California.

II. FIRE SEASON, YEARLONG FORCES

Many areas throughout the Nation do have a limited fire season for forest, watershed, and rangeland fires. This is not true in southern California. Here we have a climate situation resulting in a yearlong fire season. Eight months of the year there is either no or very little rainfall. Frequently in the other

4 months dry desert winds of high velocity and very low humidity occur during which periods watershed fires start. These fires will burn unless promptly suppressed by organized fire-protection agencies. A number of the most disastrous watershed fires in southern California and specifically in Los Angeles County, including Angeles National Forest, have started and burned thousands of acres of extremely valuable watersheds in December and January.

The United States Forest Service is charged with the responsibility of fire protection within the national forests. In southern California the United States Forest Service is financed for the so-called fire season on a 6- to 8-month basis for the larger fire-protection force. After a fire starts they can spend emergency funds—often too late. This does not include yearlong administrative personnel. As a result, fires occurring after the seasonal fire force is laid off or materially reduced must be handled by a skeletonized Federal organization which in the main is not financed or organized to handle the fires. The results are that these too numerous fires inside the Angeles National Forest must be attacked by the yearlong fire-fighting forces of the Los Angeles County Fire Department, and in some cases incorporated cities such as the city of Los Angeles. Similar situations prevail throughout the other national forests in southern California.

Alarms inside Angeles National Forest to which the Los Angeles County Fire Department responded, 5-year period

	1952–53	1953–54	1954–55	1955–56	1956–57	5-year total
FIRE SEASON						
July	4	13	13	10	11	51
August	4	8	13	8	9	42
September	7	3	6	4	11	31
October	1	4	5	5	3	18
November		3	3	1	5	12
4 MONTHS OFF SEASON						
December	3	5	5	5	7	25
January		1	1	8	6	16
February	6	2	5	4	3	20
March	1	3	2	1	2	9
Subtotal	10	11	13	18	18	70
FIRE SEASON						
April	1	1	6	2	2	12
May	1	6	6	3	7	23
June	3	5	2	8	11	29
Total	31	54	67	59	77	288

III. LOS ANGELES COUNTY COOPERATION WITH UNITED STATES FOREST SERVICE

The Los Angeles County Fire Department consisting of the forester and fire warden department and the fire protection districts, of which I am in charge under the county board of supervisors, has practically from its inception been financed and operated on a yearlong basis. My statement pertains to the watershed areas outside of the Angeles National Forest, under the jurisdiction of this department, and not to the entire strength and responsibility of this department. Actually this department is the largest county fire department in the world.

Specifically this department is directly responsible for the fire protection in county areas, much of which is adjacent to the Angeles National Forest with areas also contiguous to the San Bernardino and Los Padres National Forests. The high value county jurisdictional watersheds, which are comparable to those of the Angeles National Forest, encompass 484,124 acres. On this area in the fiscal year 1955–56, from the general county fund $1,596,550 was spent to maintain and operate those stations and personnel directly responsible for watershed fire protection. This is an expenditure of $3.298 per acre. Comparable area

within the Angeles National Forest apparently had $1.10 per acre expenditure exclusive of emergency fire-fighting funds by the Federal Government. After fires started, $1 per acre was spent—or a total of $2.10 per acre. In addition, the county general fund expenditures on low-value watersheds, such as sparsely vegetative covered areas of 746,240 acres, amounted to $685,034, or $0.918 per acre. The total amount spent for watershed fire protection in county watershed areas from the general fund for fiscal year 1955–56 was $2,577,133. This amount has been increased in subsequent fiscal years. In addition, an appreciable amount of mutual aid from the fire protection districts in emergency conditions has been given to both the Federal Government and county government. This is not considered in the above costs.

Los Angeles County has for many years recognized the need for intensified watershed fire protection both inside and outside of the Angeles National Forest. This recognition has not only been its own forester and fire warden department, but financial and mutual aid assistance to the United States Forest Service as well. This fiscal year, 1957–58, there has been allocated $60,000 of the general county fund to the Angeles National Forest for fire protection purposes. In addition, there are initial action area agreements which are nonreimbursable to the county, adjacent to and within the Angeles National Forest. In these areas both Federal and county fire protection forces respond on all fires. The Forest Service should be financed to be a full partner in this mutual assistance pact throughout the entire year. In addition, the county and some cities send on call from the United States Forest Service fire-fighting forces any place into the forest areas outside the initial action areas. Outside the initial action areas the county is reimbursed only for the overtime of its forces and other expenses incurred on the fire which are not part of its regular operational budget.

In addition, Los Angeles County has constructed and maintains from general county funds within the Angeles National Forest the following fire-control improvements; all with the permission of the United States Forest Service: Water-storage units, 63; trails, 19 miles; firebreaks, 32.4 miles; motorways, 28.3.

As a result of the disastrous Monrovia Peak fire of December 1953 and January 1954, which originated within the Angeles National Forest under extreme adverse fire-weather conditions and burned outside to county and city areas, the Los Angeles County Watershed Commission was established by the board of supervisors. This commission in 1954 sent representatives to Washington, D. C., who appeared before the United States Senate subcommittee of the Committee on Appropriations. A program prepared by the United States Forest Service, at the request of the Los Angeles County Watershed Commission and the Fire Council of Southern California, was presented for fire protection of the four southern California national forests. This program was to bring the standards up to those proposed some years ago; not those needed today, which will require more financing. As an example, the dramatic success this year of the very limited force of air tankers available in this area certainly indicates that this method of attacking fires must be expanded. These air tankers are conventional aircraft equipped with special tanks and valves which can drop large quantities of water or fire retardants directly on fires. Use this year has demonstrated that this air attack if made soon enough and in sufficient strength can be of material assistance in stopping or slowing down fires until they can be controlled by conventional ground methods. The United States Forest Service has been pioneering in this and many other phases of aerial fire attack. They should have the funds to put into action the full potential of this new aspect of fire fighting.

The program called for an annual expenditure of $2,375,000 for 10 years in addition to the then regular budgeted funds. These appearances and same program have been presented in Washington, D. C., each subsequent year by the commission and fire council. This year only $900,000 has been allocated out of the $2,375,000 annual appropriation needed.

The need for this annual increase is to enable the United States Forest Service to carry out their plan to provide the required fire protection to the national forests, commensurate with their responsibilities to the taxpayers of the counties who are more than helping themselves in this vital problem.

Over many years of observation and cooperative fire-control work with the United States Forest Service, Los Angeles County has the highest of professional commendation for their ability. The Service has the technical knowledge, experience, and progressiveness to handle the fire-control job. However, they have had to stay within a seasonal budget that is not commensurate with the problem and its solution for fire protection in southern California national forests. It is my strong belief that the United States Forest Service, if properly financed on a

yearlong basis, will most certainly do the fire-protection job that is so badly needed in the extremely high valued watershed national forests of southern California and other national forests throughout California.

The CHAIRMAN. Thank you very much, Chief Klinger. That has been an excellent and illuminating statement, and your prepared statement will be made a part of the record immediately following your oral summary. If you will remain available, we will hear from Chief Engineer H. E. Hedger of the Los Angeles County Flood Control District.

I am informed that Colonel Hedger just telephoned that he had just left his office. So it will be 10 or 15 minutes before he gets here.

It is about time for a recess anyway. So we will stand in recess for 10 minutes.

(A short recess was taken.)

The CHAIRMAN. The subcommittee will be in order.

The Chair understands that Colonel Hedger is now here.

Colonel HEDGER. That is correct, sir.

The CHAIRMAN. Colonel, we will be very happy to hear you at this time. Do you have a prepared statement, Colonel?

Colonel HEDGER. I do, sir.

The CHAIRMAN. I observe, Colonel, this statement is relatively short. You can summarize it or read it, as you prefer.

Colonel HEDGER. I would prefer to summarize it, if I may.

The CHAIRMAN. That will be agreeable, and the entire statement will appear in the record immediately following your verbal summary of it.

STATEMENT OF COL. H. E. HEDGER, CHIEF ENGINEER, LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

Colonel HEDGER. My name is H. E. Hedger, chief engineer of the Los Angeles County Flood Control District, and appearing before the committee by invitation.

The phase of fire prevention in our watersheds that concerns our district is the aftereffect upon the runoff of strong waters. We have found, both by experience and by research, that once the brush cover, the natural cover of our watersheds in this country, is destroyed by fire or otherwise that there are serious consequences both in the production of debris from those watersheds and in the increased run of water from the watersheds.

The first effect is that of erosion from the denuded watersheds that occurs in the increased erosion by sheet runoff of the rain falling on the hillsides, the increased runoff by slippage on hillsides caused by more water running in the channels that accumulates from the hillside runoff.

Of course, there is also an increased erosion by the lowering of streambeds.

All of those factors tend to increase many, many times the amount of debris that would normally come from our hillsides.

In addition, there always follows an increase in the rate of sump water runoff. The water, of course, is bulked by the mud and debris that is added to it, and by the ash, timbers, and other materials that come from the hillsides. And the result is that from these canyons that have been burned over during a major flood you will find a dis-

charge of floodwaters and debris that issues just like the blast of a shotgun. It comes with tremendous force and is fired at the residences, homes, the people that reside close to or below the mouth of these canyons.

How serious that can be is demonstrated well by reference to the flood that we had in 1934 in the La Crescenta area. There a watershed of about 7 square miles' area was burned over in November of 1933, and a little over a month following, toward the end of December, heavy rains fell. The result was that at midnight on December 31 it started New Year's Eve, the rainfall increased to the intensity of an inch an hour for about 11 straight hours, and, falling on that denuded watershed, it produced amounts of debris that averaged about 100,000 cubic yards per square mile.

That debris, as I described, was fired out of the canyons as a shotgun would be at the residences below. It completely ignored the inadequate channels that exist through the housing that had been built. It would send boulders, rocks, trees right through the houses that existed there. It destroyed some 300 homes along the channels. It left about 35 dead and a great many injured in its path.

It did not stop there. The debris is carried by floodwaters only due to the velocity of those waters, and as they go forward on their path toward the ocean, the gradient that they follow decreases, and, therefore, the velocity decreases, and the debris is deposited gradually. The result was that a good part of the area between the mouth of the canyon and the wash 2 miles below it was covered with the debris that was eroded from the hillside.

That debris had to be removed to make the houses or homes habitable that had been surrounded by the ones that were destroyed. It had to be removed from the streets to make the area accessible. The cost of removal at that time was in excess of a dollar a cubic yard. Today it would probably be several times that amount.

So you not only have the death and the destruction that comes from such an occurrence, but you have the cost of rehabilitation that follows. It is much cheaper, we believe, to protect against that sort of thing than to suffer the losses, the damage, and the rehabilitation costs that follow.

We have done the best we can to provide flood-control measures to meet the situation by constructing what we call the debris basins. They are small dams at the mouths of these canyons. They trap these floodwaters momentarily during a major storm, long enough to settle out the debris, and relatively clear water goes on downstream through the channels that have been provided. Obviously, when those basins are filled, the material must be removed to make them effective again, and that, of course, is a matter of great expense, too.

In the first year that these debris basins were constructed there was no great problem to remove the material and find a place to dispose of it. But today, some 15 or 20 years later, most of the open areas where such material could be deposited after it had been removed have been built upon, and it is not easy to find a point of disposal. You have to go farther.

The costs of removal have increased greatly, and, in time, I think we can envision there will not be any places for disposal. Everything will be owned.

So the current meeting of the situation is not going to last forever, and I think the answer is going to have to look to prevention of the fires, because of inundation.

It is going to be more important as the years go by. When you consider that Los Angeles County, which lies along the edge of the ocean, as shown by the map that was here a few moments ago, is directly in the path of some of the heaviest moisture-laden air masses that move in this direction, we are suckers for such conditions. When those air masses move down that far along the coast they are pointed right straight at this town. When they do get here they find this backdrop of mountains that reaches an elevation of 10,000 feet within 40 miles of the coast. As a result, it is practically instant condensation of the moisture in those air masses. So we have what we call cloudbursts. When we get a major storm that hits this area the result is rainfall that reaches tremendous amounts.

For instance, I think your committee will be interested in knowing—I believe it was in 1943—rainfall was experienced up in our mountain watersheds within 30 miles of here to the extent of 26 inches in a 24-hour period. One of the world's records for rainfall intensity.

When you realize conditions like that can be imposed on an area that is now occupied by over 5 million people, the immensity of this hazard is obvious, and the necessity for doing everything in the way of fire protection, fire prevention, flood control, and every phase of operation to reduce that hazard is of utmost importance.

I think that is brought out more fully in my statement.

I believe, Mr. Chairman, that is all I need to give in the way of a briefing. Thank you very much.

(The prepared statement of Colonel Hedger follows:)

STATEMENT OF H. E. HEDGER, CHIEF ENGINEER, LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, CALIFORNIA, RE LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

Mr. Chairman and gentlemen, my name is H. E. Hedger and, as chief engineer of the Los Angeles County Flood Control District, I have been requested by the chairman of your committee to present a statement on the importance of fire prevention to flood control and conservation in southern California watersheds. This I am pleased to do because of the close relationship existent, in this area particularly, between fires and destructive debris flows.

I. Destruction of watershed cover by fire results in a great increase in the flood hazard downstream and in a decrease in the conservation of runoff from the watershed due to the following phenomena

(*a*) Erosion of barren watersheds is greatly accelerated in comparison to that occurring on a watershed supporting a substantial vegetal cover. A good growth of chaparral, or similar cover type, is of considerable value in reducing debris movement from the extremely precipitous mountain slopes in southern California. Through interposition of and interception by the leafy and woody structure of the plants and their litter, impact of raindrops on soil particles is materially reduced and there is also a slight reduction in volume of water reaching the ground. Through development of humus in the soil and the extensive root systems produced by the chaparral-type plants, infiltration rates are much greater on a brush-covered slope than on a denuded slope. Hence, runoff is considerably less. Thus, a reduction in runoff in combination with the soil-protective mantle of humus and the soil-binding characteristics of the root systems in greater or lesser degree helps to reduce the four major forms of erosion. These may be described as (1) gravity erosion, which takes place immediately following a fire when small soil particles can no longer remain in place but gradually, through action of wind and gravity, collect in gullies or canyon bottoms; (2) sheet erosion, which occurs during the first and subsequent rains when innumerable gullies are scoured out of a barren hillside by rainfall concentrations; (3) bank or

side slope erosion which becomes most serious during periods of major streamflow when side slopes are undercut and landslides of considerable volume may occur; and (4) streambed erosion during which the scouring action of high-velocity flows cause degradation of the streambed if in alluvial material.

(*b*) Discharge of eroded material in considerable volume from out of the many canyons comprising our mountain watersheds occurs during storms of even minor intensity and amount when the watersheds have been burned, the extent increasing with the intensity and amount of rainfall. During the major storm of March 1938 debris production from small watersheds burned over in 1933 above La Crescenta and in 1934 above Altadena reached rates of 124,000 and 119,000 cubic yards per square mile, respectively. These were watersheds of less than 0.3 square mile in area. As in many of the smaller watersheds in Los Angeles County, the debris problem, when these watersheds were covered with vegetation, was of minor importance. During two minor storms in January 1954 debris production from Bailey, Little Santa Anita and Big Santa Anita Canyons, which were almost completely denuded by the Monrovia Peak fire in December 1953, amounted to approximately 62,000, 31,000, and 28,000 cubic yards per square mile of burned area, respectively, or, in terms of volume, 32,000, 73,000, and 296,000 cubic yards, respectively. In comparison, Hastings Canyon and Pasadena Glen, small canyons immediately west of Bailey Canyon, but not burned over, produced only a negligible amount of runoff and debris.

(*c*) Acceleration of the rate of runoff occurs following a fire on a watershed. Ash residue from humus and other vegetal matter, combined with maximum impact of raindrops, tends to seal the pores in the soil. This in turn results in a lower infiltration rate than would otherwise occur. Loss in rate of infiltration during a storm results in an increase in the rate as well as in the volume of runoff. A study of runoff of two earlier storms comparable to the storm of January 19, 1954, showed that unit peak runoff in Little Santa Anita Canyon from the latter storm, with a burned condition of watershed, varied from 4 to 6 times that occurring when the watershed was unburned, and volumetrically the unit production from the burned area was from 2.6 to 6.7 times as much as from the unburned area.

II. Erosion of watersheds

(*a*) Serious erosion of a watershed may destroy its capacity for regrowth of timber and brush. A watershed undisturbed by fire will, through a long period of years, develop a good soil mantle. Other factors being favorable, the better the soil mantle, the better can a watershed support an effective brush or other vegetal cover. Erosion consisting of extensive gullying and landslips results in the loss of valuable topsoil. For every 100,000 cubic yards of debris eroded from 1 square mile of watershed there is an average loss of 1⅛ inches of soil cover. Continued soil loss will result in a reduction in vigor and density of vegetal cover.

(*b*) This condition may create a chain reaction leading to further erosion Deterioration of brush cover results in a larger and larger surface area of mineral soil being exposed to the elements, and rates of erosion may accelerate to such a degree as to require that special remedial measures be applied to a watershed to permit natural revegetation.

III. Discharge of eroded material as debris

The effect of uncontrolled discharge of eroded material as debris in flood flows increases tremendously the destructive forces of floods. Bulking due to debris can increase the discharge from a watershed up to possibly 100 percent that of the clear flow.

Debris-laden flood discharges:

(*a*) Causes destruction of life, homes, public works, and other types of property. The New Year's 1934 storm resulted in a loss of 42 lives, destruction of 500 homes and property damage estimated at $5 million in the La Crescenta-Montrose-Glendale area, primarily caused by a flood discharge carrying large volumes of debris from 7.5 square miles of the San Gabriel Mountains burned over the previous November.

(*b*) Requires clean-up of debris deposits and damaged areas. Removal of debris from streets, highways, and private property is costly and time-consuming. Streets in Montrose following the New Year's 1934 storm were covered with debris to depths of 5 feet or more, which disrupted traffic and added to the difficulties of rehabilitation of the area. Boulders of varying size up to 40 tons were required to be moved from a street near the mouth of Dunsmuir Canyon, a small denuded watershed of 500 acres above La Crescenta.

(*c*) Necessitates heavy expenditure of public funds for corrective works. Flood control structures which include debris dams and debris basins to desilt flood discharge with a high debris content and concrete-lined channels to conduct the desilted water in an orderly manner to main collector channels have proven to be the most effective method of control. This type of construction is extremely costly but justified since less permanent type works have been found to be inadequate.

The magnitude of these flood-control works which have been under construction on the coastal side of the San Gabriel Mountains in Los Angeles County for a considerable number of years can probably best be indicated by their cost. To June 30, 1956, the Federal Government, through the Corps of Engineers for the Department of the Army and the Soil Conservation Service and the Forest Service for the Department of Agriculture, has expended approximately $189 million for such works. Including partial completion of a $179 million storm drain bond issue program, authorized by the citizens of Los Angeles County in 1952, the flood control district and other local agencies have together expended to the same date over $290 million for flood-control structures including necessary rights-of-way. Total expenditures for flood control in Los Angeles County to June 30, 1956, thus are in excess of $479 million. Further structures necessary to complete the comprehensive plan for the control and conservation of floodwaters in this area will ultimately require the expenditure of additional funds in excess of those heretofore expended.

(*d*) Greatly increases the cost of maintaining such works. Due to debris inflow, the maintenance of the storage capacity of both flood regulating reservoirs and debris basins requires the expenditure of large sums of money. The least expensive method developed by the district, that of sluicing debris from flood regulating reservoirs, can be accomplished for about $0.03 per cubic yard. However, this method can only be utilized where, in the larger watersheds, the residual flows following storms are of sufficient size, 20 cubic feet per second to 200 cubic feet per second, and duration to permit sluicing operations. In event this method is not feasible, restoration of storage capacity can then only be accomplished by removal of debris through mechanical means. Dependent upon length of haul to a disposal area, debris removal costs can range between $0.75 and $1.50 per cubic yard. On the basis of capital storm debris production rates, cost of desilting by mechanical means could thus exceed $100,000 per square mile of watershed tributary to a storage basin following a single severe storm if the area had been denuded recently by fire.

(*e*) Will ultimately blight the entire foothill development. The potential debris movement, in event of fire, from uncontrolled drainage areas discharging onto otherwise desirable lands adjacent to the foothill and mountain regions of southern California has exerted, and will continue to exert, an adverse influence on utilization of such property. Effective structural measures to protect against flood and debris damage are so costly that many years will doubtless elapse before the smaller watersheds located adjacent to urban development will be adequately controlled. Even after construction of flood-control works, the disposal of debris excavated from debris basins may in some instances become so difficult, due to nonavailability of debris disposal sites caused by intensive land utilization, that developed areas may have to be abandoned. Hence, foothill properties can never realize their potential maximum development so long as such hazard exists. With the increase in population forecast for this State, utilization of marginal lands will become increasingly necessary, and a continuing restriction in use will limit community growth.

IV. Acceleration of the rate of runoff from a denuded watershed, as mentioned heretofore, has, during storms of some magnitude, a negative effect on both the control and the conservation of floodwaters by—

(*a*) Increasing the flood hazard to developed areas affected where adequate flood control channels have not been constructed. Existing natural waterways have been encroached upon to a serious degree in many instances; hence, any increase in runoff beyond the existing channel capacity increases the extent of flood damage otherwise occurring.

(*b*) Reducing the conservation potentiality by curtailing the storage period and periods during which water spreading operations may be carried on. Conservation of storm waters in southern California to the maximum possible is recognized as essential to the public welfare. Only 1.7 percent of the mean seasonal natural runoff of California's streams is available to the South

Coastal Basin of California, whereas 51 percent of the State's population, based on the 1950 census, live in this area. Hence, public loss results when it becomes necessary to shorten the reservoir storage periods during which flood inflow can be stored for conservation use, because the increased inflow from burned areas utilizes reservoir storage more quickly and floodwaters in excess have to be discharged to the ocean to restore capacity. Likewise, loss occurs when flood discharges become so silt-laden that it is not feasible for them to be diverted to spreading grounds but must be bypassed to the ocean until such time as the water clears sufficiently to be conserved. Frequently, silty waters from burned areas deposit sufficient silt in transit along natural stream courses to seal off the porous sands and gravels through which channel percolation normally takes place. Replenishment of ground-water supplies in local ground-water basins is thus greatly reduced. This condition occurred in 1954 when, following the Monrovia Peak fire, it was possible to sluice debris from Santa Anita Reservoir. Silt deposited in the reservoir during the storms subsequent to the fire was sluiced into Santa Anita Wash and eventually reached downstream along the main collector channel, the Rio Hondo, to the vicinity of Whittier Narrows, a total distance of about 10 miles. The silt so reduced channel percolation that only about 10 percent of that which normally would result from discharge of clear flow percolated into the underground basins underlying these water courses. With the value of water conserved by spreading operations or through channel percolation, estimated at $20 per acre-foot, curtailment in the conservation of floodwaters thus represents an economic loss to the community.

V. Need for increased prefire protection measures

From the foregoing it is evident that maintenance of brush cover on the watersheds of southern California has a far-reaching effect on public welfare. Funds available for protection of the cover should, where inadequate, be increased sufficiently to provide the additional manpower, equipment, and facilities necessary to reduce the acreage burned to a negligible amount. The Forest Service has indicated that under good forest management this acreage should not exceed two-tenths of 1 percent of national-forest area.

Some of the additional capital improvements which might be financed to advantage in protecting forest areas would, it is believed, include: (1) a network of heliports to facilitate making full use of the latest development in quick, aerial transportation, (2) improving ridge tops to facilitate full use of mechanical equipment for fire suppression, and (3) additional radio communication facilities, water-storage facilities, fire stations, firefighting equipment, and fire roads.

Allocation of funds for fire protection beyond that normally provided for forest management could, I believe, be fully justified in southern California. Improved fire protection will result in fewer major fires, and thus a substantial saving in fire suppression costs can be effected and adequate fire protection of southern California watersheds will contribute appreciably to the flood protection of life and property in this area and to the conservation of one of our most important resources—water.

The CHAIRMAN. Thank you very much, Colonel, for your statement.

If we may have all five witnesses along the front row, we will ask questions en bloc.

Mr. Connaughton, if I interpret the statement made by Chief Klinger, who has the responsibility for firefighting in this area, correctly, he seems to feel the Forest Service leaves the territory pretty well denuded so far as firefighting personnel is concerned on a year-round basis. Would you concur that this area, being a unique firefighting problem, requires management which is quite different than you would say is needed up in the higher areas?

Mr. CONNAUGHTON. Yes, sir; I certainly do.

The CHAIRMAN. For instance, in the high Sierras, when the snow hits, your fire problem is ended. But the fire problem, as I understand it, just gets good and started down here at that time. Sometimes as late as December. Was it not December 27, you said, Chief, when one of your biggest fires started?

Mr. KLINGER. December 26 was Malibu, and the 27th the Monrovia Peak fire. They are the two largest fires we have had so far.

The CHAIRMAN. What are the mechanical difficulties, Mr. Connaughton, so far as the Forest Service is concerned administratively in arranging an all-year firefighting organization in southern California where we have this unique problem of fire control?

Mr. CONNAUGHTON. The Forest Service has a very definite limit of funds available in terms of its organization. With the available funds, we place our organization on what amounts to a seasonable basis. And when the funds run out we have an emergency authorization to carry us over and beyond the seasonal period, assuming the rains have not yet come.

That is just a makeshift arrangement, in that there is no continuity guaranteed to the personnel that are employed. If the emergency is still continuing at the close of the regular season, they can be continued. But they have no assurance when they start that they are going to run on through. And so we are on a hand-to-mouth basis at the close of our regular financial period.

The CHAIRMAN. Do you believe that the Forest Service can cure this situation administratively? Or do you need some new law to do it?

Mr. CONNAUGHTON. It does not require new authorization. Our salary scales are inadequate, comparatively speaking, to other forest services, and those things all combine to bring this thing into sharp focus and to emphasize the point that Chief Klinger has made, with which we are in full agreement.

The CHAIRMAN. What portion of the Forest Service's budget out in California is used on fighting fires as distinguished from just the ordinary requirements of administering your office, such as salaries and what-not for the permanent staff and crew?

Mr. CONNAUGHTON. I do not have that in terms of percentage, Mr. Chairman, but I have the total figure here.

The CHAIRMAN. Would you give us that, please?

Mr. CONNAUGHTON. I will be glad to.

Of the total regular fund—that is, other than the actual suppression activity once a fire starts—southern California, there is $2,300,000. As Chief Klinger has stated, in the past 3 years there has been an increase in that of $900,000, which is a favorable trend. For northern California there is $1,800,000. You see that is 2.3 against 1.8.

The CHAIRMAN. When you get a major fire, however, you can call on the emergency funds of the Forest Service?

Mr. CONNAUGHTON. That is correct. In the event of a fire, that is, after a fire starts, there is the emergency authorization that makes possible calling on what amounts to an emergency fund for the actual suppression of it.

The CHAIRMAN. 1956 was a tough fire year down here, was it not?

Mr. CONNAUGHTON. It certainly was.

The CHAIRMAN. How much was spent down here by the United States Forest Service in fighting fires in 1956?

Mr. CONNAUGHTON. I have that figure. The actual suppression figure for 1956 for southern California amounted to $2.6 million. That is on a fiscal year basis.

The CHAIRMAN. Was that in addition to your regular budget?

Mr. CONNAUGHTON. That is in addition to the regular budget. On a fiscal year 1957 basis, it was $3,077,008. That is in addition to the regular budget. That is for suppression action.

The CHAIRMAN. And you can add those to your regular funds?

Mr. CONNAUGHTON. That is correct; you can add those two together to get the total.

The CHAIRMAN. In other words, you spent over $5 million fighting 6 fires?

Mr. CONNAUGHTON. $5.3 million total in fiscal year 1957. That is for regular funds coupled with costs of suppression action. It was a very bad year.

Mr. SISK. Mr. Chairman, would the gentleman yield right there?

The CHAIRMAN. I would be glad to yield.

Mr. SISK. Mr. Connaughton, do I understand that 2.3 was your regular fund for fire suppression, and then you had to call for an additional $3,077,000?

Mr. CONNAUGHTON. That is correct: 2.3 and 3.

Mr. SISK. Thank you.

The CHAIRMAN. Those figures, it seems to me, are very revealing. The actual additional cost of fighting these big fires was more than your regular annual budget.

Mr. CONNAUGHTON. It certainly was.

Now the next logical question or conclusion that I come to in that respect is, if the regular budget is increased, would this emergency expenditure be necessary in the magnitude which it was? That is a matter we can only determine by practice. But we have felt through the years that, with additional regular funds, that is, the sustained activity directed at fire prevention, presuppression, prefighting activities, we can materially reduce—although we cannot guarantee it—the money needed for actual suppression.

The CHAIRMAN. Mr. Connaughton, that is one reason we are holding these hearings.

Mr. CONNAUGHTON. Sure.

The CHAIRMAN. I have always been of the belief that if there were enough work done ahead of time it would not be necessary to fight so many big fires on an emergency basis. We see the Forest Service charging up and down the State with fire trucks, bulldozers, helicopters, and these tankers. I will have to say, as I have said many times, that when they get into a fire fight they do a wonderful job ordinarily. Sometimes they goof one, like we all do, but generally they have shown a remarkable amount of aggressive spirit in the way the Forest Service has fought fires. I have been impressed with their smoke jumps as well as the use of tankers.

But it seems to me we ought to be able to limit the size of these fires. You cannot stop fires, but you might be able to keep them smaller. And it seems to me the Forest Service suffers from the fact you have a skeleton organization during one part of the year, and then you are dredging down into the jails and every place else to get fire fighters during other parts of the year, whereas, if the Forest Service had a larger permanent organization of trained people, they

could do the things that prevent these fires from getting so big, and at the same time they would have a better chance, it seems to me, to retain the kind of expert personnel you need to do an effective job, not only of fire prevention but of fire control.

How do you hang on to those fellows, to your experts, when you have an on-and-off proposition? You have a very small force, do you not, about 4 months a year?

Mr. CONNAUGHTON. That is a very real problem. We do not hang on to them nearly as adequately as we should.

May I give you a couple of figures on the need for year-long personnel on that, just to back up what you are saying.

We estimate right now there should be a total manning of 1,390 positions, of which 54 percent should be year long. In other words, 750 year-long positions. That means almost 500 more than we have today. That is what we are faced with.

In other words, we bridge the gap with temporaries. On an emergency basis, we can extend employment, but it is on a very indefinite arrangement wherein the employee has no assurance of how long he will be there, and when he will be released, because when the emergency runs out, our emergency funds run out, and we must release our seasonal men. The point you make is very valid.

Mr. SAYLOR. Would the chairman yield right there?

The CHAIRMAN. Yes, I yield.

Mr. SAYLOR. That would be a solution if the fire menace were constant, but that is what makes this the difficult problem that it is—the fire menace is not constant.

Mr. CONNAUGHTON. It is not constant in that it is with us every day. On the other hand, in contrast to typical seasonal areas, let us say in a snow country, fires can and do occur in this area in any month of the year.

Mr. SAYLOR. That is right. That is why I asked about that in your original statement.

Mr. CONNAUGHTON. Yes.

Mr. SAYLOR. And this area needs more year-round firemen?

Mr. CONNAUGHTON. Yes.

Mr. SAYLOR. But that will not solve the problem, because last year the forests were a great deal more liable to erupt in fire than they are this year.

Mr. CONNAUGHTON. It does not solve the problem, in that they will be under what you might say is fire pressure at all times. But in the interim period there is plenty of available work, needed work to be done, in the nature of preplanning and that sort of thing.

Mr. SAYLOR. That I agree with and I am willing to have some of the men provided to do that. But one of the big problems, to me, is that you are still always going to have to have an emergency fund.

Mr. CONNAUGHTON. That is right, because there is some fluctuation. On the other hand, the gap between the existing seasonal force now and the emergency is too large in my opinion. The seasonal should be pulled up closer.

The CHAIRMAN. Of course, the Appropriations Committee and the whole Congress is very sensitive to the matter of increased appropriations. But it seems to me that we could do a better job in the Forest Service and actually save money by cutting down the magnitude of these fires. We are not going to be able to stop fires. People are

going to stir and fires are going to occur. But if they do not get so big that they take a million dollars to fight them, then actually we are saving money by doing the precontrol work.

If Congress could be convinced, I think that the precontrol work would cut down the need for huge amounts of these emergency funds. I have forgotten what that is now, but it seems to me they carry a fund there of $8 or $10 million, do they not?

Mr. CONNAUGHTON. No. The basic authorization on that, I think, is $6 million which is available to expend in that respect. But in some years that is exceeded.

The CHAIRMAN. You mean nationwide?

Mr. CONNAUGHTON. Nationwide; that is right. You see the entire Nation draws on that same basic emergency authority.

The CHAIRMAN. That is a revolving fund; is it not? They keep an emergency fund of $6 million, and if it is overspent they put it back, and if it is not overspent they keep it there?

Mr. CONNAUGHTON. It is appropriated annually.

Mr. SAYLOR. The fund is appropriated annually?

Mr. CONNAUGHTON. That is correct.

Mr. SAYLOR. And if it is not expended at the end of the year it goes back into the general Treasury?

Mr. CONNAUGHTON. That is right. There has been a change in recent years over what that might have been. There may have been some uncertainty in your mind in respect to that.

The CHAIRMAN. Has any effort been made out here, especially in this area, to demonstrate to the Appropriations Committees of the Congress that adequate fire-preventive methods would actually reduce the amount of money to be spent on fighting big fires after they get started and out of control?

To give you an idea of what I am driving at—when we flew over the San Bernardino area coming back from Blythe the other day, we flew out over where some of those big fires occurred. They had made those hills baldheaded, wiped everything off the top of them for miles and miles around, and, of course, created a tremendous problem of water control and all of that, not to mention the people who got run out of the area.

Now the forest supervisor showed us a plan or a plat which had been worked up which had for its purpose being able to get to these fires. I think the chief here made the remark that you have to get on them fast enough and stop them when they are small, and lack of access is one of the big problems.

Mr. KLINGER. Yes.

The CHAIRMAN. What I want to know is whether or not there is anything here in the way of a general program to demonstrate that if the work is done ahead of time the fire fighting will not have to occur later. That is the basis, it seems to me, upon which it will be possible to convince the Appropriations Committee and the Congress itself that if the permanent, stable organization in the Forest Service were sufficiently increased we would not have to spend so much money fighting fires.

They will say, "Well, we are afraid they are going to load this organization up with more people and we will still have to go out and fight fires."

It may not be possible now to demonstrate the correctness of what we believe to be true, but is there a plan afoot on which it could be demonstrated?

Mr. CONNAUGHTON. Yes, sir, there is.

Nationwide, about 3 or 4 years ago the Congress considered this very point and made special arrangements for eight national forests in the United States which had had very severe and critical fire records, to supplement the regular funds as a measure in which it might reflect on the expenditure of the emergency funds. That was in the nature of a study.

That study has been in progress some 3 or 4 years. The Klamath Forest is considered in that study, and the Modoc in northern California.

In southern California the particular study was not involved because along about that time certain increases in regular funds were granted, and they were not included in what you might call the budget study.

So, to answer your question specifically from a nationwide point of view, there is a study directed in that general field.

Specifically from the standpoint of southern California, that is only partially so. Representation has been made to the Congress and to others on the general situation by the general citizenry here.

As I indicated earlier, there can be no guaranty, obviously, that if more regular funds are spent you will reduce the emergency funds so much. But from all of the standpoints of logical judgment, based on the technical skills available, both in the Federal Forest Service, State, and county, the facts would indicate—and the action has been taken by the State and county in that direction—that adequate expenditures in the preplanning period will reduce the control aspects once a fire starts.

The CHAIRMAN. I want to ask a couple of more questions, and then yield to somebody else here so I do not take all the time.

You sit next to the Los Angeles County Fire Department and next to the State also. I am interested to know what that does personnel-wise. It seems to me, if I were a young fellow coming up in a fire-fighting organization, I would take a long look at the Forest Service, the outfit run here by State Forester Raymond and also Chief Klinger, as a possible career, and I would look them over pretty carefully.

How does the Forest Service stand with reference to keeping its personnel? Is there any tendency of your fellows to take off and go to work for Mr. Raymond or Chief Klinger?

Mr. CONNAUGHTON. Yes, sir; not only from the standpoint of the tenure, but they are able to pay better salaries. I am glad they are able to do it from the standpoint of the people, but it is hard on us.

Mr. KLINGER. We are glad to take them.

The CHAIRMAN. Can you substantiate that? Do you have people taking the examinations now with applications filed with Mr. Raymond?

Mr. CONNAUGHTON. We have had in the past.

The CHAIRMAN. How many people have you got over there from the Forest Service, Mr. Raymond?

Mr. RAYMOND. I cannot tell how many, but a considerable number. We have more coming to us from the Forest Service than we are giving back, by many.

The CHAIRMAN. How about you, Chief?

Mr. KLINGER. We take a few of their top qualified people. By that I mean people with experience. Of course, we have to go by age in order for the retirement system, but I know in the past, in the last year, we have taken 3 or 4 of their top people.

The CHAIRMAN. I would assume you are not pirating these better experts over in the Forest Service, but you do not run them off if they come and make an application to improve their status financially and retirementwise? Is that about the way it is?

Mr. KLINGER. That is right. We are always happy to help someone better himself.

The CHAIRMAN. That brings me to my next question, and that is: There has been a reference here to cooperation among these fire-fighting agencies. Now, if a fire starts on the chief's ground, what do you do, Mr. Connaughton?

Mr. CONNAUGHTON. We offer our cooperation insofar as he needs it.

The CHAIRMAN. Do you have any authority to use Federal equipment on an area, say, of private lands?

Mr. CONNAUGHTON. There are certain zones of mutual aid, and then there are areas of reimbursement.

The CHAIRMAN. If you get a fire started up on the Angeles with a north wind blowing, I can imagine the chief would likely meet you about halfway, would he not?

Mr. CONNAUGHTON. He gets more than halfway; he gets right up there.

Mr. KLINGER. May I supplement that statement?

The CHAIRMAN. Yes.

Mr. KLINGER. We have what we call an initial-action zone. By initial-action zone I mean we go in immediately the fire is reported, right with the United States Forest Service. We have what they call reimbursable zones, where, if we go in to help the United States Forest Service, we are reimbursed. The only thing we charge for it is overtime, overtime we have to pay our personnel; not the regular time. But now we are in the course of changing this entire initial-action program to allow us to go farther back into the forest and for them to come farther into the country, with no reimbursement.

We feel this way: Any fire, if it is going to come down and endanger any part of Los Angeles County, we should not be reimbursed, and, at the same time, they should not be reimbursed if it comes out of the national forest into the county. We think it is a chance to have better mutual aid and more cooperative feeling.

The CHAIRMAN. Do you have any system set up for coordinating?

Mr. KLINGER. Yes.

The CHAIRMAN. Or you just get together on the phone. Is that it?

Mr. KLINGER. No. We have written plans, our plans all worked out. After every fire we have all of the men get together to find out the mistakes we have made between the two agencies, if any. We hope we do not make any. The cooperation there is very good.

I would like to say one thing, if I may, Mr. Chairman, that I think we are missing a good point here on the fact of the initial action on these fires. It is true that we can go out on fire prevention and do a lot of good work on presuppression, but, as you know, in the structural end of the business the first 5 minutes, they claim, are the most important in hitting a structure fire.

We have been endeavoring down here in southern California to work out a 15-minute basis to reach the watershed fires. We have not even reached the 15 minutes yet. I think that is the thing that needs to be looked into very closely, the initial action. I think if we could catch fires quicker, with more equipment than we are doing now, your costs will decrease quickly.

The CHAIRMAN. The gentleman from Florida, Mr. Haley.

Mr. HALEY. Thank you, Mr. Chairman.

I would like to direct this question to whomever can answer it.

In your program of fire prevention here, have you had a program of strip or light burning to help control these fires?

Mr. CONNAUGHTON. As a prefire measure, do you mean, Mr. Haley, or use of backfire once a fire starts? Which did you have in mind? There is both.

Mr. HALEY. Have you had either one of them in your program?

Mr. CONNAUGHTON. Well, yes. I will take the second one first.

Fire control in this area to a great extent is based on the use of fire or backfire to combat a going fire. In other words, as a fire runs ahead to run into a burn which has been purposely arranged and set against roads or natural barriers, you can effect a cutoff.

As for the other, what you might say is a fuel modification or hazard-reduction type of burn, in southern California to a very limited extent has been used. As I indicated in my prepared statement, we feel that it does have very limited opportunities in southern California. It should be explored further. We think we can use it in certain instances, bearing in mind at all times that the watershed factors and values cannot be jeopardized. We have an entirely different situation in the northern part of the State.

Mr. HALEY. In the northern part of the State you have not only less hazards, you are probably in a better position to have firebreaks and so forth to control better than you would here where you have more or less a combustible situation.

Mr. CONNAUGHTON. The slopes are different, the relation between mountains and valleys is different, the soils are different. There is a different complex.

Mr. HALEY. A lot of different problems are involved?

Mr. CONNAUGHTON. Yes.

Mr. HALEY. Mr. Raymond, if this kind of a protective program were started, what would it do to your timber growth? I am presuming you just get in and merely burn the undergrowth, but maybe it would destroy some of the timber, would it not?

Mr. RAYMOND. You are speaking of southern California conditions, Mr. Haley?

Mr. HALEY. Yes, or conditions anywhere. Of course, I realize you do not have too much timber, from what I have seen.

Mr. RAYMOND. In the south the timber is at the high elevations, much of it inside of the national forests, some of it on the farmland. But the problem of burning in the forest is rather difficult, just as bad as it is in the brush areas. The program there is to put in firebreaks so you can reach these areas and have something to work from when a fire starts. It serves much the same purpose as control strip work.

I do not know whether I have answered your question or not.

Mr. HALEY. Yes.

Mr. RAYMOND. The question of burning, of course, over private lands is a problem of land ownership management, and whether or not we put these on private lands depends on the accessibility of the land or the availability of the land to be turned over as a right-of-way to the State.

Mr. HALEY. If you found it desirable, have you sufficient authority to do that? Or have you got the right of eminent domain, got the right to go in there and take the land and take the necessary precautionary measures?

Mr. RAYMOND. On private lands we do not have the emient domain powers. We have to enter into an agreement with the landowner, obtain an easement to do these things in advance of fires. That is generally accepted procedure with private landowners. We very seldom have difficulty in obtaining a right-of-way for that purpose.

Mr. HALEY. Mr. Raymond, you would not—or would you—meet considerable opposition from conservationists, for instance, along the line of wildlife people and so forth, if you had a program of this kind?

Mr. RAYMOND. I do not believe so, Mr. Haley. The wildlife people and others recognize the value of protecting these areas from fires so far as wildlife is concerned, and from the standpoint of erosion and flood control it is pretty well understood amongst our conservation groups in California.

Mr. HALEY. I think that is all, Mr. Chairman.

Colonel HEDGER. Mr. Chairman, may I come in on that point?

The CHAIRMAN. Yes, Colonel, we will be glad to hear you.

Colonel HEDGER. I think in the populated areas of Los Angeles County at least, that the flood-control authorities would be utterly opposed to any unnecessary burning of the watershed even though it is considered in the form of lightburning. The consequences of denuding the natural brush cover are such as to increase the production of debris, which is a prime hazard in flood-control operation, to as much as 30 or more times than would normally be experienced from a normal storm.

Under that circumstance, flood-control authorities could not agree to any kind of burning that is not absolutely necessary in the populated areas.

Mr. RAYMOND. Mr. Chairman, may I comment further?

The CHAIRMAN. Yes.

Mr. RAYMOND. Certainly in any kind of a program like this, we do our planning with the other agencies involved that consider the kind of problems which Colonel Hedger brings up.

The CHAIRMAN. You do have a brush-burning program, do you not, in the State, ordered by the State legislature?

Mr. RAYMOND. The legislature back in 1945 passed a statute permitting private owners to do burning upon their lands under permit. And, as part of that and in accordance with that legislation, appropriations are obtained each year for standby equipment, for advisory services to ranchers who wish to do control burning on their land.

We also carry on some experimental work under this legislation to find out the advantages and disadvantages of control burning on range and brushland.

The CHAIRMAN. What has been your experience, Mr. Raymond? Has it been good or bad?

Mr. RAYMOND. We find some of both, Mr. Chairman. It depends upon the local conditions of soil, the management of the land, the type of burn that was attained. There are many aspects to it. In many cases we have found very fine results; in other cases they have been somewhat disastrous.

The CHAIRMAN. In other words, you get in an area like down here in the Angeles Forest and burn off that brush, and you get two things: you get a fire maybe on your hands you cannot handle, and then you get the mud and debris and rocks all rolling down the next flood you have?

Mr. RAYMOND. That is right.

The CHAIRMAN. So this matter of brush burning has to be very, very carefully tailored to the particular circumstances, the terrain, the soil and whatnot. Is that the idea?

What was the volume of control burning in California last year under this program, if you know offhand?

Mr. RAYMOND. I do not have the figure right here with me, but it is approximately, I believe, 250,000 acres.

We burned off over 1,500,000 acres in California, and much of that has been reburned. I am speaking of about a 12-year period. Much of that has been reburned after 3 to 5 years and then reseeded again. It is a continual maintenance problem of the landowner to keep the land free of brush and to keep desirable species of grass and growths growing on those lands.

The CHAIRMAN. Mr. Connaughton, is there any presently authorized Federal program of the same nature as the State's?

Mr. CONNAUGHTON. Yes, sir, we are authorized. We can carry out, under a broad authorization of proper land management, where it is applicable on the national forest, a program which might involve brush burning.

The CHAIRMAN. Has any of that actually been done?

Mr. CONNAUGHTON. Yes, sir. We have 42,000 acres now that have been treated to the processes of brush clearance, reseeding and modification of the cover.

The CHAIRMAN. Is that always brush burning? Have you never tried chemicals?

Mr. CONNAUGHTON. Chemicals have been tried to some degree, although there is a future still ahead of us. We know we can get a kill with chemicals. However, it still leaves the debris on the ground. It requires additional treatment over and above chemicals. That is if you want to convert it to range use. If you are merely trying to get rid of the brush, you can kill it with chemicals.

Let me just comment on one other point, Mr. Chairman. I would like to emphasize what the State forester has said.

There is tremendous heat generated with this brush burning problem, and it is justifiable in many respects, but much of it comes from the fact we overgeneralize individual situations. There are localities where it will work, there are localities where it will not work.

When we recognize the fundamental differences in areas and the manner in which it works, then I do not think we have much trouble getting together. Our difficulties usually arise when we overgeneralize one way or the other and run into conflicts.

Mr. UDALL. Will the gentleman yield?

The CHAIRMAN. Off the record.

(Discussion off the record.)

The CHAIRMAN. The gentleman from Pennsylvania is now recognized.

Mr. SAYLOR. Mr. Chairman, I have listened very carefully to some of the questioning that has gone on here. I do not want to propose myself as an expert forester or expert fireman or expert flood-control man, but I have a little smattering of the whole bunch of them, that is, background of a little conservation, and I am concerned, and gravely concerned, with this burning business that is going on and is proposed. Because, unless your soil is different here in California than any other place I have ever found upon the face of the earth, once you build a fire and burn on top of it, you take something out of that soil. You are going to have happen to you out here just what Mr. Hedger has pointed out: the first wind that comes along and blows it off, then comes the first rain, and along comes that sheet action, and away she goes, and you have absolutely nothing to hold it.

I think we are putting the cart before the horse, and until somebody has done some work, some agency of the State or Federal Government has done some work to determine what you are going to do with the vegetation and how you are going to replant it, we had better go awfully slow with a burning program. That is fundamentally my problem.

I think this: I think that one of the things that has bothered me in all the burnings that I have viewed, that is, you will try to burn an area—what is the difference in cost if, instead of just burning the brush in an area, you try to collect the brush and burn it in spots? Has any agency of the State or Federal Government tried that?

Mr. CONNAUGHTON. Yes. Various ramifications of that have been tried, such as crushing the brush. Sometimes the brush has been accumulated in windrows. There have been various alternatives used.

Mr. SAYLOR. But what have you done in any area now that has had a forest fire? What has been the process of the State and the Federal Government in those areas? Have you gone in and tried to clean up those areas, or have you just said, "We had a fire and it burned over 10,000 acres, and there is not much we can do about it, and let's hope it does not happen anywhere else"? Have you gone in and tried to do anything in those areas?

Mr. CONNAUGHTON. Yes, sir; very definitely. The first process, of course, has been various types and kinds of revegetation. In the flood areas, the high watershed areas, a justifiable program of watershed rehabilitation by emergency seeding has very often followed.

Mr. SAYLOR. Have you ever gone in and cleaned up an area before you reseeded it?

Mr. CONNAUGHTON. The bulk of this down here is pretty well clean when fire passes through.

The CHAIRMAN. Just a little ash lying around.

Mr. CONNAUGHTON. In some other areas, and probably what you may have in mind, snags are left, and that sort of thing.

Mr. SAYLOR. Yes.

Mr. HALEY. Will the gentleman yield for a question off the record?

Mr. SAYLOR. Yes.

(Discussion off the record.)

Mr. RHODES. Will the gentleman yield?

Mr. SAYLOR. Yes; I yield.

Mr. RHODES. Actually, I wonder if maybe we are not putting the cart before the horse a little bit on this watershed. Somebody made the remark this was the most valuable watershed in the world. I think potentially it is, but I believe you are handling it like a hot potato; you do not quite know what to do with it.

The colonel says you would have to increase your flood-control facilities if you caused high-water production. I think you would, but I think that also you might find in this water-shortage area you could store some of that water and use it for beneficial uses.

What would be wrong with putting this watershed under a sort of multiple-purpose program and trying to grow some grass up there instead of brush, which is what is causing your forest fires, and use the water which comes off, and, instead of viewing it as something you do not want, view it as something you do want?

I do not know how much money it will take. Maybe it is so expensive it is absolutely impracticable. But, believe me, as an Arizonian who is interested in your water problems, I would be tickled to death to help you out.

Does anyone want to comment on that, which may be a little bit of a revolutionary sort of thinking here, so we can use that watershed instead of being so deadly afraid of it?

The CHAIRMAN. Let's take our flood-control expert first.

Colonel HEDGER. I would like to say, first, that everything that is feasible has been done already to preserve the natural runoff from this watershed. The flood-control district I represent has about 14 major dams in the area, the Corps of Engineers has a half dozen, and, in addition, we have countless spreading areas where we take the runoff and put it underground for replenishment of the underground waters.

We have very carefully studied that out and have done everything that is feasible. In spite of that, the flood-control program that has been put into effect here will run better than a half billion dollars complete; and it is based on the maximum runoff that you get from a storm of about 50-year frequency.

Mr. RHODES. May I interrupt you there?

What kind of runoff? A runoff from the slopes as they are now, or a runoff from slopes as they might be if the brush were removed?

Colonel HEDGER. It is the maximum runoff to be expected from the slopes in their native condition. It is not based on denudation by fire.

Mr. RHODES. Do you know their native condition? Some people feel in some of our watershed areas in Arizona that the practice of fighting forest fires has caused the brush to increase in the watershed. So, they state that where there used to be wide-open areas where grass was growing, there is now nothing but brush. I wonder if the condition of your watershed might be about the same.

Colonel HEDGER. No; I think not, sir. The large volume of runoff comes from the very steep mountainsides. The problem is to get anything to grow on them; not too much growth. That is the thing we have to face—the natural condition of that watershed which is going to contribute so much water during a major storm regardless of what is done with it.

Mr. SAYLOR. Colonel, in that respect, you said you have done everything that is feasible. You have told us of all of these big dams you have built. But I have not heard of anything you have done up in the headwaters. I am one of those who believe the place to control water is where it falls, not in dams down below.

Colonel HEDGER. The dams that have been built are largely in the headwaters, Mr. Saylor.

Mr. SAYLOR. I do not know your idea of headwaters, whether it differs from mine a great deal. But I saw some of those dams and visited most of them in the State in the past 3 weeks, and most of them, I am satisfied, are down pretty well toward civilization, an awful lot of mountains back of them.

Colonel HEDGER. I think you have been looking at the Corps of Engineer dams. The flood-control district dams are all back in the watershed.

The flood-control district made an aerial survey back in 1929, when aerial surveys were few and far between, to determine all of the possible reservoir and dam sites in the San Gabriel Mountains and watershed, and found there were only three in the whole area suitable for development. Two of those have been developed, and the third was not found usable.

So I speak with authority when I say that an investigational study has been made in determining how far conservation can go.

The CHAIRMAN. Will the gentleman yield?

Mr. SAYLOR. Yes.

The CHAIRMAN. I just want to remark that these slopes are short and steep, and it creates a little different problem, I think, than perhaps you have in some other parts of the United States.

Mr. SAYLOR. Did you wish to comment on Mr. Rhodes' question, Mr. Nelson?

Mr. NELSON. Yes. First, I might comment on Mr. Haley's suggestion—[note, this was made off the record]—that we might concrete the watershed. I think there is an example of that in the coastal plain down here with these thousands of acres of highways and routes, and it does not take a very heavy storm to flood the streets in the lower part of the city here as a result of the concrete watersheds we have.

Getting back to Mr. Rhodes' question, here in southern California, in much of that brush area that was shown on the map by Mr. Connaughton, brush is the natural and original type of vegetation. Following fire, it is the natural succession of vegetation, and most of those species of brush sprout abundantly following a fire. So that the problem of controlling is extremely difficult.

Now, to establish an immediate protective cover on those watersheds, grasses are sown and it is a matter of a few years until the brush again takes over.

The forest and range experiment station of the Forest Service now is initiating a research project. We hope that, through chemical treatment, possibly we can treat firebreaks or critical areas, and maybe in the long run, when it gets cheap enough, large areas, say, following a fire where the heavy cover has been lost, to treat the sprouting material chemically so we will reduce the density and possibly also reduce the high growth of that brush, and still maintain a cover that will contribute some trash to the ground to hold it in place and help filter the water into the soil. By that method we hope we will find some

benefit that will reduce the critical fire hazards that confront us here in the South.

Going back again to Mr. Haley's point, you cannot lightburn in this country. A fire either burns rapidly and practically explodes or it will not burn at all. There is no middle ground in burning down here, it seems.

Mr. SAYLOR. Mr. Connaughton, on the third page of your statement it states:

> Man-caused fires in California national forests have declined from an average of 1,033 per year in the early 1930's to an average of 656 per year in the past 5 years.

Have any of those man-caused fires in the past 5 years resulted in a loss of life?

Mr. CONNAUGHTON. Yes, sir; they have.

Mr. SAYLOR. Could you tell us for the record which ones?

Mr. CONNAUGHTON. The one of last fall, the Inaja fire in which 11 lives were lost, and which was set by a boy. That is the most recent.

I would have to check back specifically on the others, but I am almost confident of calling to mind the next most recent loss of life was a man-caused fire.

The CHAIRMAN. Will the gentleman yield?

Mr. SAYLOR. Yes; I yield.

The CHAIRMAN. On page 9 of Mr. Connaughton's statement he has quite an extensive breakdown of loss of fire fighters that occurred.

Mr. SAYLOR. The next question I have is, How many fires have occurred in a comparable period in the national forests, both man-made and natural?

Mr. CONNAUGHTON. I do not have the lightning fires added to this. That is what you want?

Mr. SAYLOR. That is right.

Mr. CONNAUGHTON. I would have to get that for you.

Mr. SAYLOR. I would appreciate very much if you would get it. I would like to have it for comparison.

Mr. CONNAUGHTON. We certainly will provide it for the record.

Mr. SAYLOR. Because, if my information is correct, lightning causes a great deal more fires, nature causes more than man does.

Mr. CONNAUGHTON. No.

Mr. SAYLOR. Not in this area?

Mr. CONNAUGHTON. No; not in a normal year. Let me get those figures for you, Congressman.

Mr. SAYLOR. All right. I would appreciate it very much.

I want to congratulate your whole group for the cooperative spirit which you have shown here in working with each other. I think you have got a real problem, and I think the statement of Mr. Hedger showing how he disagrees with your burning policies because of—

He shakes his head and says he does not agree with that. But, if I read it correctly, he did not come out and say so, but, believe me, he certainly showed what happens when there has been a fire, regardless of who sets it or what causes it. I think it is important that his statement points up the importance of the working together of all agencies in this area and any area, in fact, on this great problem.

That is all, Mr. Chairman.

The CHAIRMAN. The gentleman from North Carolina, Judge Shuford.

Mr. SHUFORD. There are only 1 or 2 questions I have in mind. I would like to ask Mr. Connaughton about those.

Are there more forest fires originating in the national forest than out of the national forest in this area?

Mr. CONNAUGHTON. Total?

Mr. SHUFORD. Yes.

Mr. CONNAUGHTON. I do not have that comparative figure. We can get that for you.

Mr. SHUFORD. I would like to know that, because I was under the impression one of the witnesses stated this morning—I think it was the chief—a good may of the fires started in the mountain section and came down into the brush area.

I am like Mr. Saylor. I want to congratulate you gentlemen for the splendid cooperation you have shown with each other in fighting the fires in this section.

Of course, I come from an area where we have more water than you have here, and you know, Mr. Connaughton, the situation we have there.

I think it boils down to this, as far as I can see, that the main trouble in fighting fires here is that the Forest Service has not been getting sufficient money to carry on this very necessary work in this State.

Like our chairman, Mr. Engle, I think that some study should be made, and some report should be given to the Congress to justify an additional allowance for this work so that you can cooperate with the other gentlemen in fighting the fires in this area.

I was very much interested, Mr. Connaughton, in the remark made about the brush that follows a fire. You know in our area we have fire cherry that comes in right after a fire. We do not know why, but it does, and that gives way to spruce and hemlock.

Mr. NELSON. Mr. Chairman, I would like to make a brief statement in regard to manpower.

We believe that the strong initial attack from an adequately distributed fire-fighting force is fundamental in fire protection. We believe that yearlong employment of key personnel is also fundamental.

The State now has most of its key personnel in the fire-fighting classes on a yearlong basis. Mr. Raymond mentioned a moment ago the movement of a good many pieces of equipment and manpower from the north into the south to meet this threat which always comes here in this area during the fall season when we get those eastern and northern winds.

It is because of the yearlong staffing of those key personnel with the State division of forestry that he has those men that he can move into this critical area at this time.

It would certainly be helpful if Mr. Connaughton and his organization could do likewise when the critical period in the north is over, if he could move some of that personnel, if he had them, after the calendar fire season, into the south to strengthen all of our forces during this critical period.

Mr. SHUFORD. Mr. Connaughton, do you have that authority now to bring them down from the north so you could use them in the south?

Mr. CONNAUGHTON. Yes, sir.

Mr. SHUFORD. Would not that help your manpower situation some?

Mr. CONNAUGHTON. Yes, sir; to some degree. However, the real basic thing—although I am in full agreement with the program as outlined, their base organization is still here, and this is just a group on top. Our base organization is still inadequate in terms of our comparative needs, but this other could be worked out.

Mr. SHUFORD. You do have the right to move those extra men down to augment your force here?

Mr. CONNAUGHTON. Yes; we have.

Mr. SHUFORD. But you still think your base organization is not sufficient?

Mr. CONNAUGHTON. Yes.

Mr. RAYMOND. May I comment also, Mr. Chairman?

The CHAIRMAN. Yes.

Mr. RAYMOND. We are able to do this because the last session of the legislature appropriated funds which were to maintain on a year-round basis our foremen and truck drivers and equipment operators, who always in previous years before that, except for a certain few, had to be laid off in the fall of the year. We are now on a yearlong basis on those personnel, and we can move them from northern California to southern California; whereas previously, when the fire season ended in northern California, we had to lay them off.

The CHAIRMAN. That is an interesting point.

Mr. SHUFORD. I yield back any time remaining, Mr. Chairman.

The CHAIRMAN. The gentleman from California, Mr. Hosmer.

Mr. HOSMER. I would like to pursue one line of questioning with you, and it is with respect to the personnel you hire who have been in the United States Forest Service.

Do you find any particular type of training that you have to give them in order to fit them into your organization, Chief Klinger?

Mr. KLINGER. You see, we have a very unique organization. We not only fight watershed fires, we have an oil problem and a structural problem, and we have to train them in that line of work—yes.

Mr. HOSMER. Do you have to give them any special training with respect to watershed fire fighting?

Mr. KLINGER. No, because the United States Forest Service, the State, and Los Angeles County all work together in the training program. When they have a training program we go in, and vice versa. So everyone is in accord with the training program.

Mr. HOSMER. So your answer would be the same concerning any State board people you may hire?

Mr. KLINGER. That is true.

Mr. RHODES. Will the gentleman yield?

Mr. HOSMER. Yes.

Mr. RHODES. I would like to ask a question along personnel lines, too, but directed to Mr. Connaughton.

Have you ever considered the possibility of putting your personnel under the wage board instead of classified civil service?

Mr. CONNAUGHTON. Yes, sir.

Mr. RHODES. Why would not that settle the problem as far as disparity in wages is concerned?

Mr. CONNAUGHTON. I wish I could give you a good, logical, intelligent discussion of the merits of the wage board versus classified civil service, but I cannot. It is a very real problem in terms of comparative wage scales, wage board and civil service, if you shift from one to another.

There is the problem of the 8-hour law in relation to the wage board.

Mr. RHODES. If you think there is any possibility this wage-board approach might help your problem, I think it would be well for you to prepare a supplemental statement and submit it to the committee so we can perhaps be helpful to you on that.

The CHAIRMAN. Will the gentleman yield?

Mr. HOSMER. Yes, I yield.

The CHAIRMAN. As I understand, there is a bill pending in the Senate this year that has a direct bearing on this problem of equalizing your staff people, which would have a tendency to even the situation up. I think it lets you put certain types of employees under the wage board so that you can pay them overtime or double time. The thing looked a little more equal.

Mr. CONNAUGHTON. Let me ask Mr. Crafts of our office, who is familiar with pending legislation, if he could comment on that.

Mr. MERLE LOWDEN (U. S. Forest Service, Washington, D. C.). I will comment on that.

The CHAIRMAN. Identify yourself for the record.

Mr. LOWDEN. I am Merle Lowden, Director, Division of Fire Control, Forest Service, Washington, D. C.

That is the Johnston amendment. I assume that is what you are referring to.

It would be helpful in this situation, but it would leave much yet to be done. In other words, it would not cure the situation we are talking about here, in our opinion.

The CHAIRMAN. Thank you very much.

Mr. RHODES. Will the gentleman yield?

Mr. HOSMER. Yes.

Mr. RHODES. Do you feel, Mr. Lowden, there would have to be some legislation to take care of the problem on which we find ourselves in this particular area?

Mr. LOWDEN. Mr. Rhodes, we really do not know the full solution to this problem. I think Mr. Connaughton has given a good answer. We do have some studies underway. There are certain problems of being under the wage board, which he has mentioned, which still do not give us a happy and good solution to this problem.

Mr. RHODES. I presume when you get through with this study you will let us know your recommendations. Thank you.

Mr. HOSMER. I yield back the balance of my time.

The CHAIRMAN. The gentleman from California, Mr. Sisk.

Mr. SISK. Mr. Connaughton, I am particularly interested in the research work that is being done by the Forest Service with reference to control and so on. What actually is the situation so far as appropriations are concerned on research, scientific development work, in an attempt to discover means of elimination of fires?

Mr. CONNAUGHTON. With reference to fires?

Mr. SISK. That is right; with reference to fire control, fire prevention, the whole thing, because I have been much concerned with that, have talked to a number of your people and with you from time to time on this. I am curious to know just how inadequate or how adequate you may think your present manpower is from the standpoint of research and development.

Mr. CONNAUGHTON. I am glad you asked that question, Congressman, because I wanted an opportunity to introduce Director Arnold of our forest experiment station, and he would be in a good position to comment on that. If it is agreeable, I would like to introduce him and ask him to comment on it. He is here with me today.

Mr. SISK. Is it permissible to have Mr. Arnold comment with reference to research, Mr. Chairman?

The CHAIRMAN. We will be glad to hear you.

STATEMENT OF KEITH ARNOLD, DIRECTOR, CALIFORNIA FOREST AND RANGE EXPERIMENT STATION, UNITED STATES FOREST SERVICE

Mr. ARNOLD. This past year there was $250,000 increase in funds available for forest fire research.

The Association of State Foresters and other groups, in studying the fire research needs, have suggested for several years that a beginning on an adequate fire research program would come at about a level of a $500,000 increase in research funds.

Mr. SISK. Right there, Mr. Arnold, could I ask you a question?

Did I understand you to say that this year you received a $250,000 increase?

Mr. ARNOLD. That was nationwide.

Mr. SISK. Nationwide. What is the total nationwide budget budgeted to research and fire prevention and so forth?

Mr. ARNOLD. The particular figure escapes me now. It is somewhere in the order of about $450,000. I would like to be able to check that.

Mr. SISK. $450,000 nationwide?

Mr. ARNOLD. That is right. I would like to be able to check that figure before confirming it.

I think the Association of State Foresters, in their study, and the American Forestry Association, in coming up with the figure of a $500,000-a-year program, considered that as the beginning increase which might lead to a rather rapid improvement of information relative to how fires burn and to the development of new and better fire-fighting techniques and equipment.

Mr. SISK. Are you speaking of a nationwide program or of a State program?

Mr. ARNOLD. Nationwide.

Mr. SISK. I would like for you, if you can, to discuss also about how much of this present nationwide budget is being used or is subject to your use here within the State of California. Not necessarily just southern California but the entire State.

Mr. ARNOLD. Yes.

In California, the fire research budget that is available to the experiment station is about $170,000.

Mr. SISK. What is the State of California doing with reference to Mr. Raymond's agency? Are they cooperating in this research?

Mr. ARNOLD. The State this year, that is this fiscal year beginning in July, for the first time had a fire research budget of $50,000. I would say all but about six or seven thousand dollars of that have gone into cooperative programs with the Forest Service.

We could detail these if you wished, but they are in fire prevention, both man-caused and lightning; the development of aircraft and chemicals for that sort of an approach. They are in the field of weather and fire danger rating studies.

We could go into detail if you wish.

Mr. SISK. I appreciate your statement, and, while you are on your feet, would you tell me how much additional—I am speaking of California specifically. Of course, I understand it is a nationwide program and something we would probably approach on that basis. But how much additional money for research, experimental development, could you efficiently use in California today in addition to what moneys you have for this year?

Mr. ARNOLD. In California we have a fire research council which was formed under the general offices of the State forester, Mr. Raymond. It includes all of the fire services, the United States Weather Bureau, and private industry, the lumber industry primarily.

This council has recommended 2 or 3 major projects that they do not feel are adequately covered. One of these deals with reducing the fire hazard of fuels. Another one is to study the economics of fire control in all aspects.

Another one was the operations analysis of firefighting methods, and along with increasing the activity particularly in fire weather and fire procedure.

Roughly, to meet the needs of the fire research council, it should take a fire research program twice as large as we have now.

Mr. SISK. It would take one twice as large as you have now to really do the job in an adequate and expeditious manner?

Mr. ARNOLD. Yes, sir.

Mr. SISK. Thank you, Mr. Arnold. I appreciate these comments because I have been very much concerned with this research and experimental work. I think it will ultimately come up with answers which can contribute to a solution to this problem.

As one of you gentlemen mentioned this morning—Colonel Hedger or someone—it is becoming increasingly a necessity to stop these fires, and, with the growing population, exploding fires are not very nice.

Mr. RHODES. Will the gentleman yield?

Mr. SISK. I will be glad to yield to the gentleman from Arizona.

Mr. RHODES. At this point I think we should say that it is going to be completely impossible to stop fires on a slope which is covered with brush. You can talk about stopping it all you want to, but it just is not physically possible. You are going to have fires.

Mr. SISK. I appreciate the statement of my colleague from Arizona, and I would like to say at this point, although I believe Colonel Hedger did not agree, I was inclined to agree to a considerable extent with the statement by the gentleman from Arizona. There again I do not set myself up as an expert, but I am interested in some of these problems.

Up in our area we have been concerned with brush eradication. Do I understand that in this particular area you actually want the brush there? You feel it aids?

Of course, we can never eliminate fire if we are going to have the brush.

Colonel HEDGER. I will answer that from a flood-control standpoint.

We want no reduction whatsoever in the natural holdback of the trees on the watershed. Brush at the present time is nature's way of holding that back.

I think the gentleman from Arizona will be much interested in knowing that part of the research that is being conducted is on finding a fire-resistant or, we might say, fire-protective type of vegetation that will replace the brush cover, and many dollars are being spent and great progress is being made in that research.

Certainly from a flood-control standpoint we would like to see the day when these hills would be covered with green vegetation that will not burn, but in no event do we want something substituted for what we have that will increase the debris production which we have to deal with in storms.

Mr. HOSMER. Will the gentleman yield to me?

Mr. SISK. I will be glad to yield.

Mr. HOSMER. How much attention does the county of Los Angeles planning authority pay in approving the subdivisions for the location of houses at the base of these watersheds? Is any preventive to that type of subdividing being done?

Colonel HEDGER. Yes, sir. The county has an ordinance that requires our organization to report on the flood hazards facing any proposed subdivision in county territory, and most cities refer most subdivisions within their boundaries for a flood-control report.

The committee may be interested in knowing in recent years, if our organization reports a flood hazard to a piece of property that is to be subdivided, in many instances the subdivider finds it desirable to finance himself the flood-control improvements that are necessary to remove the flood hazard from that piece of property.

Mr. HOSMER. What kind of a report did your organization make on this area you related lost some hundred homes or more?

Colonel HEDGER. That was before the ordinance was established. That was in 1934.

Mr. HOSMER. When was the ordinance established?

Colonel HEDGER. I think immediately after that; about 1936.

The CHAIRMAN. Let's get the rest of these answers to the gentleman's question with regard to the desirability of brush.

Would you like to comment on that, Mr. Raymond?

And then you, Chief.

Mr. SISK. I want particularly Mr. Nelson to comment on that. I realize the problems are different up and down the State. While I disagree wholly with the gentleman here, I will admit the contours of the land and other things may change it.

Mr. RAYMOND. I would like to make a very brief comment, Mr. Chairman.

The problem here in this area is a local problem of treating the lands in which you have a so-called Mediterranean climate which falls between two extremes. It falls between them, but is a part—the

extreme of cold and hot. And these types of vegetation that grow in these areas have to meet those kind of conditions. You cannot just take these off and put just any vegetation back in their place. That is the difficulty of finding some other vegetation to take the place of the natural vegetation here.

It is not a matter of planting grasses, for example, and having them take the place of brush. In the particular soil and climate conditions it is a big problem.

Mr. SISK. Do you mean to say that, in reseeding, grass just will not grow, will not take root on these particular mountains because of the soil?

Mr. RAYMOND. You have problems in that particular area because you have the seepage, you have a constant movement of soil even when it is dry. You have an erosion of soil under even conditions on the steep mountain slopes. It is a granitic soil; it is not conducive to growing of grass. You have long dry periods and so on. The other plants will not tolerate that kind of condition.

These brush species that grow on these mountains have pretty much conditioned themselves over the centuries to the type of climate and type of soil involved. It is very difficult to find a substitute which will hold the soil in place and grow and stand the type of climate we have.

The CHAIRMAN. Mr. Klinger.

Mr. KLINGER. I think they have covered it very nicely.

The CHAIRMAN. Mr. Connaughton.

Mr. CONNAUGHTON. I am glad to have a chance to comment on that. There again we have this situation: If we generalize such a thing as brush removal, we immediately run into difficulties.

Up in your area, Mr. Sisk, there are some soils supporting brush now which can and will support grass. The slopes generally are not like they are in the steep rugged fronts. So a conversion is perfectly logical and possible where prior soil analysis has shown that the soil will support grass.

I am sure you also readily recognize there are a number of soils in your area that now support brush that will not support grass too, and that is a mistake when you overextend it.

Now you come into this area. Insofar as the national forests are concerned, generally speaking, no one has any particular defense of brush as such. It is merely that, as of today, we do not know how to cope with the watershed problem and administer and manage the watershed effectively with less than that brush cover. We do recognize certain individual spots and locations, little benches and areas scattered throughout southern California that might be converted from brush to grass, and have been in certain cases for various purposes. But, percentagewise and in the aggregate, they are so different from the country you come from that it poses an entirely different set of circumstances and problems.

I say again it is almost an acre-by-acre determination when you begin to talk the philosophies of brush control or brush modification. When you can stand on the ground and see it, I am almost confident that fair-minded men will get together. On the other hand, where you discuss away from the ground, each one of us thinks of something different, and oftentimes we arrive at different conclusions.

The CHAIRMAN. Did the Chief get in on this?

Mr. KLINGER. I said they did a nice job.

Mr. SISK. Yes, Mr. Nelson.

Mr. NELSON. I do not think I can add anything to what Mr. Connaughton has said.

Mr. SISK. I appreciate very much the statement of all of you gentlemen. I have been very much interested in this.

It seems to me, at least by your position, Colonel, you are pretty well admitting there is no possibility of eliminating fires in this area, that you are going to have fires and have them pretty consistently.

Then it would seem to me that you are confronted in this area—if you concede that, which you seemingly do—with one alternative, and that is to develop through Los Angeles County, State and Federal, a fire-fighting force that will be able to hit that fire within 10, 15, or 20 minutes as a maximum. I see no other alternative.

So that means more men, better equipment, and better access.

I want to ask a question with reference to the higher, more remote areas. What is the situation with reference to funds for development of access to get in there? That is all chargeable in your particular case to the general funds that are appropriated to you. Is that right?

Mr. CONNAUGHTON. That is right, from the standpoint of roads.

Mr. SISK. Do you feel there is a need along that line?

Mr. CONNAUGHTON. Yes, sir.

Mr. UDALL. Will the gentleman yield?

Mr. SISK. Yes, I yield.

Mr. UDALL. I have information that has been furnished me that fiscal 1957, nationwide and particularly in California, was a year of extraordinary costs for fire fighting. Bearing on the question the chairman raised, the Budget Bureau made the Forest Service people—instead of allowing them to ask a supplemental appropriation for the full amount they had to spend for extraordinary forest fires—they made them absorb a substantial amount, if not most of that money, and that meant they could not engage in access road programs, and had to cut back research and the timber sales program.

It seems to me a rather shortsighted way to approach such a serious problem.

Mr. SISK. Do you have any comments on that, Mr. Connaughton?

Mr. CONNAUGHTON. There were some adjustments.

Mr. SISK. To sum the whole thing up, you need more money. Right?

Mr. CONNAUGHTON. Well, our plans call for more than we have now.

Mr. SISK. Let me conclude, and I appreciate the time of the committee.

I want to commend the Forest Service people, both the Federal and State, on their cooperation and coordination, because I have had some firsthand experience in riding with the rangers in covering the pretty hot fire we had up in Sequoia last year when we almost lost the fire, as you remember. And to see the cooperation between the State and Federal Government was rather an amazing thing. I think it was something to inspire us all. It is too bad that on other things we do not get the same type of cooperation, but certainly you people are to be commended in doing a terrific job in standing shoulder to shoulder. I want to commend you for it.

The CHAIRMAN. The gentleman from Arizona, Mr. Udall.

Mr. UDALL. This subject of control burning interests me a great deal.

Mr. Connaughton, a year ago I was up in the high country in our State, the White Mountains on the Apache Reservation, and was shown some of the areas where control burning had been carried out by the Chief Forester. I think they wait 2 or 3 weeks until the moisture content of the air is just right and there are no winds, and they move into areas that have very heavy brush and debris undergrowth. This is high mountain country. I was quite impressed with the results that had been obtained. They picked areas where there was high danger of forest fire.

We heard a lot this morning in terms of generalities about controlled burning.

I want to ask you and Chief Klinger and those who participated in the big fires you had last year—the Cleveland fire, the Malibu, and so on—looking back now, do you feel there were control strip burnings that you might have done which would have helped to control those fires?

Mr. CONNAUGHTON. Just let me make this general comment and then ask Chief Klinger to take over from his standpoint.

Obviously, if there were broad strips of nonflammable fuel or no fuel at all, any fire control effort would be facilitated. Whether it would be practical in any one of these individual fire situations to so create one by any one of the various processes known to us, I do not know. My guess would be, without present knowledge in terms of the watershed values, there are not many of those opportunities available to us under the particular situation you described. However, I would like Chief Klinger to supplement that.

Mr. UDALL. Yes.

Mr. KLINGER. First, let me say this, that everyone refers to the Malibu fire. Actually the reason the Malibu fire was such a major disaster was the fact we had five major fires going at one time. Three of those fires were actually in the Malibu area. So you can see the condition that we had.

Mr. UDALL. Were they all man-caused?

Mr. KLINGER. One we have not been able to determine, and the other two we believe to be man-caused.

Due to the high wind of this fire, in my opinion, if you had had control burning or strip burning you would have had to make them so wide Colonel Hedger would have had a flood control problem. We had a high wind condition and a very low humidity.

Just to give you an example, Dr. Arnold measured the humidity at the ocean at 3 o'clock in the morning, and it was 7. He took out the wind meter when the second fire occurred, and the wind measured up to 50 miles, and he hit the peg and put it away so he would not have to make out a 2-page report on a broken instrument; 60- and 80-mile winds and strip burning in that case would not have helped unless 2 or 3 miles wide because the fire itself was jumping half a mile, three-quarters of a mile at a time.

Mr. UDALL. So, from the standpoint of fighting a forest fire, you had about as bad a situation as you could possibly get?

Mr. KLINGER. Yes.

Mr. UDALL. And in those situations control burning just is not the answer unless you burn wide areas, practically make a forest fire anyway?

Mr. KLINGER. That is right.

Mr. UDALL. I am curious about your specific experience in this field recently.

The CHAIRMAN. You cannot use tankers when you get winds of those velocities, can you?

Mr. KLINGER. No. We attempted to use tankers, but it was impossible because the water dispersed.

The CHAIRMAN. Instead of coming straight down, it would go sideways?

Mr. KLINGER. I do not think any ever hit the ground.

The CHAIRMAN. Then your problem was really one of access?

Mr. KLINGER. That is correct. We were very fortunate in that we probably have 500 miles of motorways in the county of our own, and possibly 200 or 300 miles of firebreaks in that area. We did a lot of backfiring from these firebreaks, such as we do. But the wind conditions and the humidity—never in the history of California weather reporting has weather been reported as bad as that.

Mr. UDALL. Just one other thing.

We heard mention earlier of some State law that permits individuals who have homes in areas that might be in dangerous locations as far as fires to do elective burning in the immediate area, probably on their own property. Were there many homes that might have been saved by people who had not really taken any precautions at all on their own part?

Mr. KLINGER. Yes.

Mr. UDALL. There were?

Mr. KLINGER. Yes.

The CHAIRMAN. There is one question I would like to ask before we adjourn.

On page 9 of your statement, Mr. Connaughton, there is the statement:

> Another indication of the southern California fire problem is that there the average-size fire on national-forest land in 1956 was 227 acres. This contrasts with 31 acres on all national forests in California and 19 acres for all national forests in the country. It has been possible to reduce the average size of fires in the last decade about one-third for all national forests, but in southern California there is no significant trend toward reduced average size.

Now that is a very significant statement to me because I am perfectly sure you are not going to stop all of these fires. What we ought to try to do is to reduce their size.

I was impressed with the fact that in other areas of the United States there has been a steady trend to reducing the size of those fires, which means you get on them faster and put them out quicker, and the damage is less, and the cost of suppression is immeasurable less.

What reason do you give for the inability in southern California to make any significant progress toward reducing the average size of these fires?

Mr. CONNAUGHTON. There are a number of reasons, and I cannot give you an exact evaluation of them. But let's run down a few of them.

We have been experiencing a severe drought in southern California for the last 10 years. We have had increased hazards as a result, and burning conditions have picked up. The accessibility in this country has not changed materially since the days of the Civilian Conservation Corps. So there has been no adjustment on that score to get to fires quicker, whereas in many other areas, particularly with our timber-access program, we have improved accessibility materially.

Encroachment of structures at the edges of the brush fields has resulted in some of these fires reaching rather large sizes.

Another thing that pushes the average size up: If you average this in a frequency distribution, we have held the bulk of the fires to a low figure, but 10 of them still got away, and that pushes this average up out of line.

So, with all of those things considered—and there may be some other factors that could be very significant——

Mr. SAYLOR. What would have been the effect if you would not have had the 10 fires in there that ran away? Do you have any idea?

Mr. CONNAUGHTON. Compared to the national average?

Mr. SAYLOR. Yes.

Mr. CONNAUGHTON. I would have to refigure that, but that would bring it way down toward the national average.

Mr. SAYLOR. I think the committee ought to have that because I think it would change materially if the effect of the 10 fires caused you to go above the average or that far above the average.

Mr. CONNAUGHTON. I do not know how that would figure out.

Mr. SAYLOR. And indicate to people in California the combination of State, Federal, and local have been doing a good job.

I think, Mr. Chairman, it would be interesting to the committee if Mr. Connaughton could furnish that. Take the 10 out and then——

Mr. CONNAUGHTON. Figure the average by size class as it goes up.

The CHAIRMAN. Yes.

Would you prepare an additional comment elaborating the statement that appears on page 9 of your statement which I just quoted?

Mr. CONNAUGHTON. Yes.

The CHAIRMAN. Because it is significant. If we could cut down the size of these fires, we would be going places.

Mr. CONNAUGHTON. That is right.

The CHAIRMAN. I would like to have you analyze that, as Mr. Saylor suggests, in the light of the size of the fire.

When you throw out these that got away from you—sometimes got away under circumstances where the Lord himself would have been hard put to hold them, with the high wind and the low humidity and all of that—perhaps you are not doing as badly as you think.

We may have problems that are almost insoluble in some instances here with reference to fire, and we want to find out what they are.

Has the gentleman from Arizona, Mr. Udall, finished?

Mr. SISK. Will the gentleman yield to me?

Mr. UDALL. Yes.

Mr. SISK. Mr. Chairman, I have just one further question here, and this is not to create any controversy.

Has there at any time been any real controversy or difference of opinion between the National Forest Service people, the State people, and the Los Angeles County people. and my friend, Colonel Hedger, over here on what could be done for fire prevention?

I realize you people have cooperated. I understand your willingness and desire to compromise and give and take. All in all, I think you have done a good job. Yet I know people in my own area are bitterly opposed to control burns, and I know my good friend, Mr. O'Neil, up there just practically carries his gun for those kind of people. So there is a difference of opinion.

I am curious to know to what extent you may or may not agree with Colonel Hedger's opinion over here. I would like for you to comment. And without any heat on it.

Mr. CONNAUGHTON. I am glad you brought this up, because our official position is in harmony with Colonel Hedger.

Policywise, between the State and the county and the Federal Government, I do not think there is any disagreement.

Individually within all organizations probably there are various degrees of opinion on certain of these things, but, even so, I am not even aware that that exists.

In other words, to the best of my knowledge, from the Federal standpoint there is unanimity of opinion.

Mr. NELSON. I will confirm that for the State.

Colonel HEDGER. I would like to confirm it also. The reason I shook my head when Mr. Saylor quoted me as being opposed to the policy of the Federal agency is that their policies here in Los Angeles County and ours are together. They do not attempt to use control burning. My statement, Mr. Sisk, was limited to the populated areas of Los Angeles County and to the burning of brush cover in the mountain watershed here. I do not care to express an opinion whatsoever as to what the policy might be otherwise in other parts.

Mr. SISK. I appreciate that statement and realize we are dealing specifically now with the situation in southern California.

I happen to be one of those people—and I have seen it demonstrated—that think control burning is an excellent thing in certain areas. I think we have some excellent examples up there.

I want to ask about the San Joaquin experimental range which I am sure you are familiar with. They are dealing with many things, of course, besides fire. They have also done control work there.

Are you familiar with and do you feel that program is receiving adequate financing?

We tried to get some extra money this year, and I think we did.

Mr. CONNAUGHTON. May I refer that again to Mr. Arnold?

Mr. SISK. What is happening up at the San Joaquin experimental range at the present time, Mr. Arnold? Do you want to comment at all on that?

Mr. ARNOLD. From the standpoint of the San Joaquin experimental range, I believe there is adequate financing at this time. There was an increase this past year that brought it up to about the strength that makes it an effective unit at this time.

Mr. SISK. Did we get the $25,000 out there?

Mr. ARNOLD. We got part of it. We did not get all of the $25,000.

Mr. SISK. Thank you, Mr. Chairman.

The CHAIRMAN. The subcommittee will stand in recess until 2 o'clock.

(Following is the letter from Regional Forester Charles A. Connaughton, prepared in response to the chairman's request for an elabo-

ration of forest-fire data assembled on the national forests of southern California:)

DEPARTMENT OF AGRICULTURE,
FOREST SERVICE, CALIFORNIA REGION,
San Francisco, Calif., October 18, 1957.

Re legislation, Federal (fire hearing, southern California)
Hon. CLAIR ENGLE,
House of Representatives,
Washington, D. C.

DEAR MR. ENGLE: During the hearing held by your committee in Los Angeles, October 8 and 9, several questions were presented to the United States Forest Service for reply at an early date.

Information pertinent to these questions currently available follows:

1. Question: What is the breakdown in the total number of fires on the national forests of southern California between man-caused and lightning?

Number of fires and area burned by cause in the national forests of southern California

Year	Man-caused		Lightning	
	Number	Area burned (acres)	Number	Area burned (acres)
1952	213	11,101	60	130
1953	243	100,338	65	21,507
1954	171	28,144	71	150
1955	125	62,734	63	14
1956	206	67,758	53	119
5-year average	192	54,015	62	4,384

2. Question: What was occurrence of fires inside and outside the national forests of southern California?

Occurrence of fires in southern California inside and outside the national forests [1]

Year	Number of fires inside national forests	Number of fires outside national forests
1952	270	495
1953	308	827
1954	237	440
1955	185	604
1956	251	642
5-year average	250	602

[1] These data are based on the Cleveland, San Bernardino, Angeles, and main division of Los Padres National Forests with comparative figures for San Diego, Orange, Riverside, San Bernardino, Los Angeles, Ventura, Santa Barbara, and San Luis Obispo Counties. To obtain comparable county statistics the number of fires in the Monterey ranger district of Los Padres National Forest has not been included thereby making slightly different totals than shown elsewhere for the fires in southern California national forests.

3. Question: If recent fires more than 10,000 acres in size are excluded from the averages, what will be the adjusted average size of fire on the national forests of southern California and its relation to the nationwide average?

For the period 1951–56, the average size of fire in the national forests of southern California excluding all fires larger than 10,000 acres was 77 acres. Including the fires of more than 10,000 acres raises the average to 225 acres per fire.

There appears to be several reasons why average size of fire is large in southern California compared to nationwide averages (average size of fire on national forests nationwide in 1956 was 19 acres). Of dominant importance is the fact that, for the period under consideration, there has been a continued drought with accompanying high-hazard fire weather in southern California. These conditions

have created a disproportionately greater opportunity for spread of fire in this locality as compared to the Nation at large. Second, the improvement in access by road construction in rough mountain areas designed to increase timber harvest in forested regions elsewhere has not occurred on the brush-covered mountains of southern California. This means that speed of attack on fires and access to going fires has not increased as favorably as it may have elsewhere. Third, southern California inherently has all elements which result in large fires to an exaggerated degree, such as steep topography, highly flammable fuel, and long periods of extreme fire weather.

In addition to these questions, information was requested on certain budgetary and personnel matters which has nationwide implication and will require study and response from the Chief of the Forest Service. Information will be supplied on these subjects as soon as available. Furthermore, you asked us to review some questions raised by one of the witnesses. This review will require field contacts which will be made shortly, after which a report will be submitted.

Sincerely yours,

CHAS. A. CONNAUGHTON, *Regional Forester.*

(Whereupon, at 12:30 p. m., the committee recessed until 2 p. m.)

AFTERNOON SESSION

The CHAIRMAN. The subcommittee will be in order.

Is Prof. H. H. Biswell here?

Mr. BISWELL. Yes.

The CHAIRMAN. Are you prepared to make your statement?

Mr. BISWELL. Yes.

The CHAIRMAN. Is Prof. A. W. Sampson here?

Mr. SAMPSON. Yes.

The CHAIRMAN. Is Harvey W. Brelsford here?

Mr. BRELSFORD. Yes, sir.

The CHAIRMAN. Professor Biswell, you have a prepared statement which, I observe, is not too long except for the attached matter, and we will be glad to have you either read the statement or summarize it, as you choose. Then we will have Professor Sampson and Mr. Brelsford, and then we will question these gentlemen en bloc, if agreeable to the committee.

Hearing no objection, that will be the order, and these witnesses may proceed without interruption to either read their statement or summarize it, and thereafter we will question them en bloc.

We are glad to have you here, Professor, and we know you are busy and have other things to do. So, you may go right ahead.

STATEMENT OF H. H. BISWELL, PROFESSOR, SCHOOL OF FORESTRY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.

Mr. BISWELL. Mr. Chairman and members of the committee, California has a Mediterranean-type climate with long, hot, and dry summers. As the season progresses, the fire hazard becomes extremely high. Both fire protection and damage are costing millions of dollars annually. Under present management practices, this cost and damage will continue and greatly increase.

Wildfires in forest: Before settlement, fire was a natural force in developing the virgin forests. Fires were set by lightning and Indians. The history of early fires in California forested areas is well known from studies of healed-over scars which are to be found on the trees themselves. A detailed study on the Stanislaus Forest, where data were collected on 74 acres of the mixed conifer forest type,

showed that 221 distinct fires burned this area between 1454 and 1912. This averages a fire about every 2 years.

Another study, which required cutting down thousands of trees, furnishes the most complete record of fire scars in the California pine region, and gives a cross section of the fire history. The distribution and dates of the major fires are graphed on the next page. This shows the occurrence of fires under pristine conditions from 1685 down to 1900. These are the major fires that occurred throughout California.

The virgin forests which burned under natural conditions were open and parklike according to Jepson, one of our early-day botanists. The soils and other features of the forests developed under such conditions of frequent light fires.

In the past 50 years, fires have been suppressed. This practice is absolutely essential, of course, because of development and forest use. But this practice is fighting nature, and such action always results in trouble. A governing principle in wild-land management should be to conform to the laws of nature insofar as possible and to base methods on these laws.

As a result of fire suppression over the past 50 years, fuel has accumulated in great quantities in forest areas, and its structure has changed in such a way as to increase fire danger. This fuel will eventually catch fire. If that happens in late summer, the result may be catastrophic.

Several such fires have occurred in recent years; for example, the Wright's Creek Canyon fire of 26,000 acres on the Stanislaus Forest in 1950, the Haystack fire of 87,000 acres in northern California in 1955, and numerous fires in southern California, such as the Sulfur and Fish Creek fires in 1953, and the McKinley and Pacifico Mountain burns in 1956.

Now these two pictures will give you a little idea of the fuel situation I am talking about.

This picture was taken on the Big Oak Flat Road near Yosemite National Park. When I say the structure of the fuel has changed, I mean something like this [indicating]. Here are a lot of little trees under the big trees. So the fuel structure has changed.

The worst thing about modern-day fires is that the forest tree cover is almost completely destroyed. With present bad fuel conditions, such fires can and will happen in many other forest areas in California, because such conditions exist almost everywhere. For example, on the Big Oak Flat Road into Yosemite Park and, in fact, around the Tuolumne big-tree grove itself, a serious fire-hazard situation exists. The stage in that area is all set for a fire of holocaust proportions. When such a fire will break out, no one knows, but the threat is constant each summer when the fuel is dry, the humidity low, temperatures high, and the wind strong.

People should be deeply concerned about fires in timber, because the time required for recovery of tree stand to former status is not 2 to 12 years, as in grass and brush, but may be 100 to 150 years, if at all. Certainly, recovery will not be in our lifetime.

Because of this extremely slow recovery, holocaust fires of a few thousand acres each year will soon take on vast proportions; 10,000 acres each year will add up to one-half million acres in 50 years.

What can be done about this deplorable forest-fire situation?

We have two choices. One is to build more access roads and to intensify suppression. This method has received much attention, but it will not solve the fire problem and it intensifies soil erosion.

The second choice is to reduce fuels and to manage forest areas with the objective of low fire danger uppermost in mind. This method, although given little attention thus far, offers a solution to the problem, and is the one I want to discuss.

Fuels and fire hazards in ponderosa pine can be reduced by prescribed burning under appropriate circumstances. This conclusion is based on 6 years of study in second-growth ponderosa pine at Hobergs in Lake County and on the Teaford Forest in Madera County, and from work by Weaver and others. Prescribed burning is done in the fall, winter, and spring when the soil is wet and the danger of wildfires is relatively low. In this work we are cooperating with nature and perhaps improving upon her by deliberate burning when the soil is wet. The techniques of prescribed burning in ponderosa pine are given in the publications attached.

On the basis of this work, three recommendations are offered:

1. Prescribed burning in ponderosa pine should be pursued vigorously to reduce fire hazards to a tolerable level. There is scarcely a ponderosa pine area in California in which the fire hazard cannot be reduced. Such burning should be started in strategic places where it will do the most good. For this purpose I want to borrow an idea from the Swedish Forest Service. This service employs professional broadcast burners. They are the elite among the Swedish Forest Service personnel, and are looked upon with the greatest respect.

In California it is particularly essential that burning in timber be done only by well-trained and qualified men. The State and Federal services should undertake to train a core of specialists to serve as crew leaders in prescribed burning. These men should be alert, creative, responsible, well paid and sufficient in number to deal effectively with the problem of hazard reduction. As a start, perhaps 100 men should be trained. They should have good judgment and the patience required in burning. They should be employed year long in planning and carrying out prescribed burning on both public and private lands that are under fire protection.

All of this time I have been talking about ponderosa pine. Now in my second point I am talking about research on fire use in other forest types, and on other means of fire-hazard, reduction should be started at once.

Since State and Federal services already bear much of the cost of fire suppression it would seem appropriate for them to also assume a share of the cost of hazard reduction on private lands. Careful study should be given to specific ways in which such cost could be borne in part by public agencies. A possible approach would be to request the agricultural-conservation program of California to make cost-share payments for the cleanup work following burning on private lands. The Federal Government is making payments for pruning and thinning, amounting to 75 percent of the cost but not to exceed $40 per acre. To make payments for cleanup in ponderosa pine forest areas would be real conservation work.

Now I want to discuss the subject of wildfires in brush.

Less is known about the history of fires in brush under pristine conditions than about that of fires in timber. It is known, however, that

before settlement the brushlands burned occasionally from fires set both by lightning and Indians.

Whether or not fire suppression will answer the wildfire problem in brush is unknown. At present, however, it does not look too promising.

A recent report on the debris potential of small watersheds of the Los Angeles County coastal plain throws light on this important problem. This area is one of great concern to the people of Los Angeles; fire protection there is intense.

To determine whether there has been a decrease in wildfires on these watersheds resulting from increased fire protection or an increase due to the greater fire incidence associated with population gains, the cumulative annual burn for all watersheds was plotted for the past 50 years. It was found that a straight line best fit the sequence of points, indicating that there has been essentially no change in the annual burn rate for the past 50 years.

The acreage likely to burn annually in each mountain group of watersheds was also determined. It was shown that this rate is remaining constant. Since the conditions described above have been happening on these watersheds under intensive fire protection, one wonders if fire protection alone is the answer to the wildfire problem in the southern California chaparral brushlands.

Following fire, brush recovers to its former density and height in 10 to 12 years; total weight continues to increase longer. After 12 to 15 years, dead material begins to accumulate and gradually increases in proportion to the living parts, finally making up a large percentage of the total. With the accumulation of dead material, the fire hazard gradually increases and finally reaches a high level. Fires burn vigorously when the proportion of dead material is high.

Wildfires in brush burn more intensely than those in grass, and are more difficult to control. Furthermore, after fire in brush the soil is left more exposed and erosion is greater than after fire in grass.

On the basis of the above conditions and results, these recommendations are offered:

1. Convert areas of brush to grass when areas are suitable for grass production. Study use of fertilizers and herbicides in maintaining grass stands.

2. Study and test control burning on a rotation basis as a means of reducing fire hazard and easing control of wildfires in chaparral. Perhaps 5 percent of an area should be burned each year, giving a 20-year rotation.

Control burning should be done in the spring when the danger of wildfire is not too high, and, if possible, when the soil is wet. The objective should be to have a dense stand of young brush fairly free of dead material.

No. 1 was something to do, and No. 2 is sometime to study and test.

The planning of rotation burning includes planning for postburn management. Proper timing of seeding and fertilization and the position of 1 year's burn to another in the rotation can be carefully scheduled so as to minimize erosion. Studies should include measurements of erosion under rotation burning compared to that from wildfire burns.

Thank you very much.

(The graph and prepared report submitted by Mr. Biswell follow:)

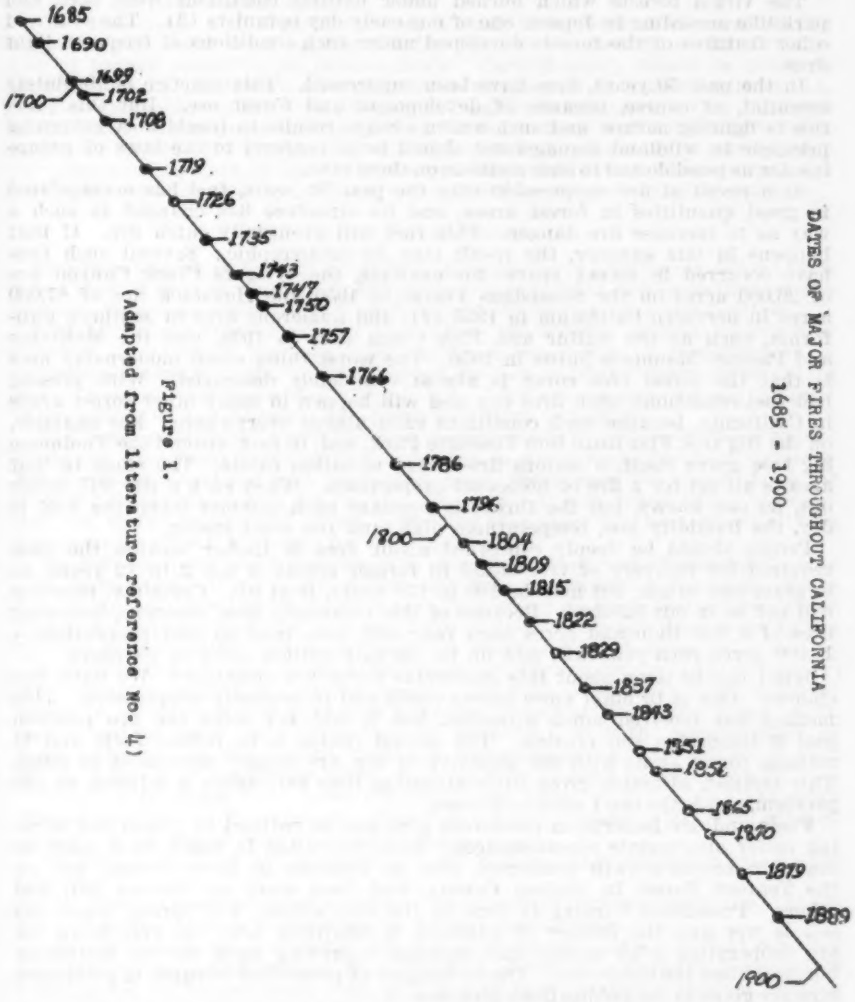

Figure 1.

(Adapted from literature reference No. 4)

STATEMENT OF H. H. BISWELL, WILDFIRES IN FOREST AND BRUSH, OCTOBER 8, 1957

California has a Mediterranean type climate with long, hot, and dry summers. As the season progresses, the fire hazard becomes extremely high. Both fire protection and damage are costing millions of dollars annually. Under present management practices, this cost and damage will continue and greatly increase.

WILDLIFE IN FORESTS

Before settlement, fire was a natural force in developing the virgin forests. Fires were set by lightning and Indians (5). The history of early fires in forested areas is well known from studies of healed-over scars which are to be found on the trees themselves. A detailed study on the Stanislaus Forest, where data were collected on 74 acres of the mixed conifer forest type, showed that 221 distinct fires burned this area between 1454 and 1912 (4). This averages a fire about every 2 years. Another study, which required cutting

down thousands of trees, furnishes the most complete record of fire scars in the California pine region, and gives a cross section of the fire history. The distribution and dates of the major fires are graphed on the next page.

The virgin forests which burned under natural conditions were open and park-like according to Jepson, one of our early day botanists (3). The soils and other features of the forests developed under such conditions of frequent, light fires.

In the past 50 years, fires have been suppressed. This practice is absolutely essential, of course, because of development and forest use. But this practice is fighting nature, and such action always results in trouble. A governing principle in wildland management should be to conform to the laws of nature insofar as possible and to base methods on these laws.

As a result of fire suppression over the past 50 years, fuel has accumulated in great quantities in forest areas, and its structure has changed in such a way as to increase fire danger. This fuel will eventually catch fire. If that happens in late summer, the result may be catastrophic. Several such fires have occurred in recent years—for example, the Wrights Creek Canyon fire of 26,000 acres on the Stanislaus Forest in 1950, the Haystack fire of 87,000 acres in northern California in 1955 (7), and numerous fires in southern California, such as the Sulfur and Fish Creek fires in 1953, and the McKinley and Pacifico Mountain burns in 1956. The worst thing about modern-day fires is that the forest tree cover is almost completely destroyed. With present bad fuel conditions, such fires can and will happen in many other forest areas in California, because such conditions exist almost everywhere. For example, on the Big Oak Flat Road into Yosemite Park, and, in fact, around the Tuolumne big tree grove itself, a serious fire-hazard situation exists. The stage in that area is all set for a fire of holocaust proportions. When such a fire will break out, no one knows, but the threat is constant each summer when the fuel is dry, the humidity low, temperatures high, and the wind strong.

People should be deeply concerned about fires in timber because the time required for recovery of tree stand to former status is not 2 to 12 years, as in grass and brush, but may be 100 to 150 years, if at all. Certainly, recovery will not be in our lifetime. Because of this extremely slow recovery, holocaust fires of a few thousand acres each year will soon take on vast proportions—10,000 acres each year will add up to one-half million acres in 50 years.

What can be done about this deplorable forest-fire situation? We have two choices. One is to build more access roads and to intensify suppression. This method has received much attention, but it will not solve the fire problem and it intensifies soil erosion. The second choice is to reduce fuels and to manage forest areas with the objective of low fire danger uppermost in mind. This method, although given little attention thus far, offers a solution to the problem, and is the one I want to discuss.

Fuels and fire hazards in ponderosa pine can be reduced by prescribed burning under appropriate circumstances. This conclusion is based on 6 years of study in second-growth ponderosa pine at Hobergs in Lake County and on the Teaford Forest in Madera County, and from work by Weaver (8), and others. Prescribed burning is done in the fall, winter, and spring, when the soil is wet and the danger of wildfires is relatively low. In this work we are cooperating with nature and perhaps improving upon her by deliberate burning when the soil is wet. The techniques of prescribed burning in ponderosa pine are given in the publications attached.

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(1) Prescribed burning in ponderosa pine should be pursued vigorously to reduce fire hazards to a tolerable level. There is scarcely a ponderosa pine area in California in which the fire hazard cannot be reduced. Such burning should be started in strategic places where it will do the most good. For this purpose, I want to borrow an idea from the Swedish Forest Service (2). This Service employs professional broadcast burners. They are the elite among the Forest Service personnel, and are looked upon with the greatest respect. In California, it is particularly essential that burning in timber be done only by well-trained and qualified men. The State and Federal Services should undertake to train a core of specialists to serve as crew leaders in prescribed burning. These men should be alert, creative, responsible, well paid, and sufficient in number to deal effectively with the problem of hazard reduction. As a start perhaps 100 should be trained. They should have good judgment and the patience required in burning. They should be employed year long in planning

and carrying out prescribed burning on both public and private lands that are under fire protection.

(2) Research on fire use in other forest types, and on other means of fire-hazard reduction should be started at once.

(3) Since State and Federal services already bear much of the cost of fire suppression it would seem appropriate for them to also assume a share of the cost of hazard reduction on private lands. Careful study should be given to specific ways in which such cost could be borne in part by public agencies. A possible approach would be to request the agricultural conservation program of California to make cost-share payments for the cleanup work following burning on private lands. The Federal Government is making payments for pruning and thinning, amounting to 75 percent of the cost but not to exceed $40 per acre. To make payments for cleanup in forest areas would be real conservation work.

WILDFIRES IN BRUSH

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Whether or not fire suppression will answer the wildfire problem in brush is unknown. At present, however, it does not look promising. A recent report on the debris potential of small watersheds of the Los Angeles County coastal plain throws light on this important problem (1). This area is one of great concern to the people of Los Angeles; fire protection there is intense.

To determine whether there has been a decrease in wildfires on these watersheds, resulting from increased fire protection, or an increase due to the greater fire incidence associated with population gains, the cumulative annual burn for all watersheds was plotted for the past 50 years. It was found that a straight line best fit the sequence of points, indicating that there has been essentially no change in the annual burn rate for the past 50 years.

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1. Biswell, H. H., A. M. Schultz, and J. L. Launchbaugh; 1955. Brush Control in Ponderosa Pine. California Agriculture 9 (1); pp. 3 and 14.
2. Biswell, H. H., and A. M. Schultz; 1956. Forest Tinder in Ponderosa Pine. California Agriculture 10 (2); pp. 6–7.
3. Biswell, H. H., and A. M. Schultz; 1956. Reduction of Wildfire Hazard. California Agriculture 10 (11); pp. 4–5.
4. Biswell, H. H., and A. M. Schultz; 1957. Surface Runoff and Erosion as Related to Prescribed Burning. Journal of Forestry 55; pp. 372–374.
5. Vlamis, J., H. H. Biswell, and A. M. Schultz; 1955. Effects of Prescribed Burning on Soil Fertility in Second-Growth Ponderosa Pine. Journal of Forestry 53: pp. 905–909.
6. Vlamis, J., H. H. Biswell, and A. M. Schultz; 1956. Seedling Growth on Burned Soil. California Agriculture 10 (9); p. 13.

Statement prepared by H. H. Biswell for Representative Clair Engle's subcommittee (of Committee on Interior and Insular Affairs) hearings in Los Angeles on October 8 and 9 on forest and brush fires:

BRUSH CONTROL IN PONDEROSA PINE—TECHNICS OF PRESCRIBED BURNS TO ENCOURAGE GROWTH OF DESIRABLE GAME BROWSE IN SECOND-GROWTH TIMBER, BY H. H. BISWELL, A. M. SCHULTZ, AND J. L. LAUNCHBAUGH

Fire as a tool in the multiple-use management of second-growth ponderosa pine is under study in California.

The primary purpose of the studies is to find ways to manipulate brush for game-range improvement, but it is impossible and undesirable to separate detailed recognition and study of the several other benefits and effects.

STUDY AREAS

Two study areas were selected—one is in the North Coast Range and the other is in the central Sierra Nevada. The North Coast area is at Hobergs in southern Lake County where the elevation is 3,000 feet and the annual average precipitation is 60 inches. Ponderosa pine is the dominant tree, with small amounts of sugar pine, black oak, and Douglas-fir present. Common and whiteleaf manzanita—both nonsprouting shrubs—comprise most of the brush, although small, pure stands of deerbrush and occasional western mountain mahogany and flowering dogwood plants are present.

The Sierra Nevada study area is in the Teaford Forest near North Fork in Madera County—elevation 4,000 feet, precipitation 35 inches. Here ponderosa pine is dominant, with incense cedar, sugar pine, and black oak trees infrequent. The nonsprouting Mariposa manzanita and wedgeleaf ceanothus and the deerbrush and the most abundant shrubs. Gooseberry also occurs.

Characteristically, both areas consist of fully stocked stands of ponderosa pine about 60 years old, with nearly impenetrable understories of living and dead manzanita and scattered openings of almost pure brush. The forest site is rated as No. 2, or better, for timber production.

Prescribed burning, as used in forestry, means that fire is used for certain definite reasons, and the conditions for firing are carefully planned in advance. In the Hobergs and Teaford Forests, two steps—broadcast burning followed by cleanup burning—were involved in the operation.

BROADCAST BURNING

Broadcast burning is done by ranking a trial and igniting the pine needles on the edge. The broadcast burning is done after enough rain has fallen to wet the duff to the mineral soil—not before. The top needles dry in a day or two after rain and burn readily. The burning is best done when the relative humidity is above 20 percent. However, it is possible to do broadcasting burning successfully with the humidity as low as 15 percent, or higher than 90 percent. Temperatures should be below 65° to prevent excessive scorching of needles. The s oil is always moist or wet. Best results are obtained by burning downhill because the fire proceeds slowly and applies more heat on one spot for a given period of time. Thus it consumes more coarse debris, has lower flames, and is easier to control. The wind should not be high, but slight movement is desirable to keep the flames down. Broadcast burning at Hobergs has usually been stopped early in April but is safe about a month longer at the greater elevation near North Fork.

Cleanup burning consists of piling and burning dead brush, slash, felled dead trees, and prunings after the area has been broadcast burned. The procedure is to start the fire and gradually pile on the dead material as it burns. One percan frequently keep a half dozen or so brush piles burning. The dead brush is not piled and left before it is burned at a later date.

Cleanup burning can be done under a wider range of conditions than broadcast burning. The current study has shown that brush piles can be safely burned with the humidity as low as 11 percent. On the other extreme, piles can be effectively burned during light rains. Wind is less important than with broadcast burning. Piles are placed so that tree trunks, especially of timber crop trees, will not be damaged. Under the conditions specified, fire seldom creeps from the brush piles if the area has been broadcast burned just prior to the cleanup.

From the time of the first rain of 1 inch or more and up to April 1 of the past 2 winter seasons at Hobergs, there were 51 and 55 days where conditions for broadcast burning were satisfactory, and 75 and 87 days for cleanup burning. There were 42 and 43 days during which either rain or snow was falling, and only 23 and 12 additional days for 1952–53 and for 1953–54 in which no burning was practical.

ROLE OF PRESCRIBED FIRE

The role played by prescribed burning in brush manipulation and game range improvement is complex. It kills seedlings and the thin-barked mature manzanita bushes, and consumes the wood; it stimulates the germination of brush seeds and later becomes the tool with which to eradicate them; the ashes and reduction of litter provide a seedbed for the artificial or natural establishment of desirable browse species. Fire encourages the stamp-sprouting of such palatable plants as black oak, dogwood, western mountain mahogany, and deerbrush. Burning stimulates the growth of legumes, many of which are palatable as forage and may increase soil nitrogen. Finally, the investment in the improved and managed area is protected by fire hazard reduction. Experimental work on each of these items is in progress.

The effects of prescribed burning on the forest itself and on other land uses are also being studied. The studies include the use of fire in improving composition of forest stands and the effects on forest tree growth; the preparation of seedbeds and the effect on forest reproduction; the effect of fire on seedeating rodents, on soil fertility, water yield, and recreation; and on the economics of the practice of prescribed burning in land management.

The above progress report is based on research project No. 1,360.

The above-reported studies are part of a project conducted cooperatively by the University of California and the California Department of Fish and Game.

Removal of Tinder in Ponderosa—Prescribed Burning of Forest Brush During the Wet Season by Tested Methods Effectively Reduces Hazard of Wildfire

By H. H. Biswell and A. M. Schultz

Dead material in second-growth ponderosa pine is one factor contributing to destructive, uncontrolled fires in summer.

Techniques of prescribed burning—as demonstrated in studies of brush management for game habitat improvement during the past 4 years—can reduce the tinder material in a forest and lower the fire hazard.

In the use of fire as a game range management tool in second-growth ponderosa pine brush, the conditions for firing are planned in advance.

Prescribed burning means that fire is used—for some definite reason—in 1 or more of 4 steps: (1) broadcast burning; (2) piling of course material by hand and burning; (3) crushing with bulldozer in open areas and burning; and (4) pruning of dead limbs and burning. Such burning is done only in the fall, winter, and spring when the soil is thoroughly wet and the hazard to wildlife is relatively low.

In broadcast burning, the pine needles furnish the fuel to carry the fire and are essential to its success. The surface pine needles may be sufficiently dry to carry fire within a day or so after rain. The fire is then set so it will burn downhill. Demonstration has shown that a fire on some slopes will burn lightly downhill but on the same slope may burn out of control if allowed to burn uphill. Broadcast burning is largely a skill best gained through experience and actual practice.

The broadcast fire does well when the relative humidity is about 25 percent and the air temperature 65° F. or below. A slight breeze is desirable. In areas of flash fuel and much dead material that has accumulated over many years, the lower needles must be wet and the fire must be particularly light or else the heat may become too intense for the trees.

After broadcast burning, the remaining coarse material is piled and burned in numerous open spots. This is done in areas of dense trees. The technique is to start a small fire and to gradually add the fuel as it burns. Studie of time required to do this work have shown that 1 person can pile and burn about 1,000 pounds per hour. Because this operation follows the broadcast burning, it can be done under a wider ranger of weather conditions since the fire hazard has already been decreased.

In areas where the trees are scattered and a bulldozer can be maneuvered among them, it is used to crush brush. After the brush is dry it can be burned broadcast.

Dead limbs should be pruned, piled, and burned with the coarse materials left by broadcast burning.

The fire hazard can be reduced still more by thinning trees to the approximate proper stocking. Such stands produce about 750 pounds of dead needles per year, whereas in a heavily overstocked stand it is about 1,500 pounds. Many of these dead needles are on the trees at the height of the critical fire season in late summer.

In strategic areas it may be desirable to perform all of these steps, but in many other places 2 or 3 broadcast burnings in yearly succession may destroy enough of the dead material to reduce the fire hazard to a satisfactory level.

Simple tests were made to determine the effectiveness of broadcast burning in reducing the fire hazard during the following summer. On test day in late June the relative humidity was 64 percent and the air temperature 60° F. but the heavy fuel in untreated areas was dry to the mineral soil. Even under the relatively low fire hazard conditions, fires started in the untreated areas burned fiercely.

Lighted kitchen matches were thrown into the needles, landing no less than 3 feet from each other. Where these started fires and the fire went out before a spot had burned 12 inches in diameter, the test was considered negative, or fire-out; where fires expanded to more than 12-inch spots, the test was considered positive. The results are given in the accompanying table and show clearly that broadcast burning in the spring has a very positive effect in reducing the ease with which fires start in the summer. Broadcast burning in November before the needle fall was complete also reduced the number of fires that spread.

In the past 4 years, two small wildfires have occurred on treated areas, one on August 20, 1954, in 2-year-old needle fall, the second on April 12, 1955, in 1-year-old needle fall. Both fires were easily controlled. No trees were killed and the lower leaves were scarcely scorched. Measurements of needle fall on burned areas compared to those unburned confirm this observation, as indicated in the graph.

The above progress report is based on research project No. 1,360.

The above-reported studies are a part of a project conducted cooperatively by the University of California and California Department of Fish and Game under Federal Aid in Wildlife, Restoration Act Project California 31–R.

Hazard of wildfire reduced by prescribed burning

Treatment	Number of test	Number of matches thrown	Number of times fire went out	Number of times fire expanded	Percent of times fire went out
Unburned (check)	1	8	3	5	37.5
	2	8	0	8	0
Approximate weight of needles on ground per acre equals 11,500 pounds	3	9	2	7	22.2
Broadcast	1	8	7	1	62.5
Burned Nov. 17	2	8	1	7	62.5
Approximate weight of needles on ground per acre equals 475 pounds	3	9	2	7	22.2
Broadcast	1	8	8	0	100
Burned Apr. 5	2	8	8	0	100
Approximate weight of needles on ground per acre equals 42 pounds	3	9	9	0	100

REDUCTION OF WILDFIRE HAZARD—CORRECT TIMING OF PRESCRIBED BURNING OF DEAD VEGETATION IN TIMBER REDUCES DANGER OF UNCONTROLLED FIRES IN THOSE AREAS

(By H. H. Biswell and A. M. Schultz)

Dangerous fire situations may be created in areas of second-growth ponderosa pine left unburned for a number of years and thereby permitting a buildup of dead shrubs, needles, and other litter—the rough—as well as overpopulations of small trees. When such areas are burned by wildfire in summer, or fall, all living vegetation is apt to be killed and a poor land condition results.

To determine the best timing for the removal of rough in second-growth ponderosa pine, records were kept of the days during three wet seasons when prescribed burning could be done safely at Hobergs, in Lake County. These records are given in the graph on the next page.

Hobergs is an area of about 600 acres where conditions of slope and fuel were quite variable. The days recorded in the graph are those on which a prescribed—broadcast—burn carried satisfactorily through the upper layer of pine needles, the flash fuel, old stumps, and much of the other debris. The number of days varied from 47 to 53 a season. It was also possible to burn in early April, and some years into May.

Once the pine needles and the soil beneath them are thoroughly wet, the lower layers dry out slowly giving long periods when prescribed burning can be done. For example, in January and February of the 1952–53 wet season it was possible to burn for 29 successive days before it became too dry to burn in heavy rough without excessive risk of the fire getting out of control. Again, in the 1955–56 wet season it was possible to prescribe burn each day for the month of March.

Although the pine needle duff dries out slowly in the lower portions next to the wet soil, it usually dries quickly in the surface inch, making it possible to begin burning within a few days after a rain. Experience has shown that the upper pine needles will burn when most people think the needles are too wet. Occasionally snow on the ground at Hobergs prevented burning for considerable periods of time even though the weather was clear.

In a program of prescribed burning, fires are set under the wettest conditions that fire will carry through the pine needles. Usually this will be on south exposures. As the program progresses and the rough becomes less, later fires may be started under progressively drier conditions.

Prescribed burning is also being carried on at the Teaford Forest near North Fork in Madera County. Here the elevation is about 3,500 feet and there is apt to be more snow on the ground than at Hobergs. While detailed records were not kept for the Teaford Forest area, fewer days were available for broadcast burning during midwinter but the burning extended for a longer period into April and May. On north exposures good burning conditions often extended to mid-May.

From the standpoint of damaging trees, prescribed burning should be stopped when weather temperatures reach 75° F., or when the trees break dormancy and their buds are no longer protected from the heat of the fire.

Prescribed burning can be dangerous—yet, most anyone can quickly learn to do it—experience and patience are the two most important attributes in successful burning.

The above progress report is based on Research Project No. 1360.

[Reprinted from Journal of Forestry, vol. 55, No. 5, May 1957]

Surface Runoff and Erosion as Related to Prescribed Burning[1]

(By H. H. Biswell and A. M. Schultz)

The improvement of game habitat in second-growth ponderosa pine through prescribed burning has been under study in California for the past 5 years.[2] One of the principal benefits gained from burning has been that of reducing danger from wildfires in summer (1, 2). Some of the burning has been done on slopes as steep as 43 percent. This has caused some people to wonder if it accelerates runoff and erosion. During the 1955–56 season very heavy rains falling on burns of different ages on slopes of different degrees afforded an opportunity to survey indicators of runoff and erosion as related to the prescribed burning. The observations were based on qualitative criteria, something like those described by Gleason in Indicators of Erosion on Watershed Land in California (3).

Fortunately, within the same areas as those prescribed burned are a State highway, private roads, a bulldozer fire lane, a powerline right-of-way cleared to mineral soil, and bare skid trails from recent logging. One skid trail going straight down a 30-percent slope was partly bare, partly covered by natural needle fall, and partly covered with needles placed by hand. All of these various situations within a relatively small area made an ideal setup for comparisons.

The results are based on qualitative criteria and are given with the thought that they should be helpful to watershed specialists or others who might have an opportunity to make more detailed studies related to this kind of work. Up to the present time, such studies have not been made. Studies nearest to the subject are those reported by Rowe and Colman (4); however, their burning techniques were different than those we used, consequently, their results do not apply to our observations.

Our work was done at Hoberg's in the coast ranges of northern California on Salminas gravelly loam. This soil is formed in place from andesitic and related igneous rocks. It is slightly to moderately acid and has a depth of 3 to 4 feet with very little differentiation in the profile. The soil is moderately permeable and well drained. In this area the seasonal precipitation is normally about 60 inches but during the 1955–56 season it was 75 inches from September 14 to April 30.

Two very heavy rainstorms periods occurred during that season; one in the December of 35.61 inches in 12 days, another in February of 20.71 inches in 7 days. The distribution of precipitation by days during these two storms is shown by the following figures. Data on maximum intensity for shorter intervals of time are not available.

Date December 1955:	*Precipitation (inches)*
16	0.27
17	.43
18	.75
19	12.72
20	6.05
21	1.26
22	6.46
23	3.67
24	.66
25	.46
26	2.16
27	.72
Total	35.61

Date February 1956:	*Precipitation (inches)*
19	1.45
20	4.35
21	5.53
22	6.17
23	1.82
24	.27
25	1.12
Total	20.71

[1] A portion of this research was done under Federal Aid in Wildlife Restoration Act, Project California W–51–R.

[2] Prescribed burning is defined as the application of fire to forest lands under such conditions of weather, soil, moisture, time of day, and other factors as presumably will result in the intensity of heat and spread required to accomplish specific silvicultural, wildlife, grazing, or fire-hazard reduction purposes.

The techniques of prescribed burning in second-growth ponderosa pine in California were described by Vlamis, Biswell, and Schultz in the December 1955 issue of the journal (5). The burning is done in the fall, winter, and early spring after rainfall and when the top needles are dry but the lower duff and the mineral soil are wet. Under these conditions the fires usually consume about half of the needles and duff and leave half. For example, in an area where the needles and duff weighed 22,866 pounds per acre before the fire, they weighed 10,375 pounds after prescribed burning. Even after 2 or 3 burns in successive years an appreciable amount of duff and debris remain above the mineral soil (fig. 1).

Most of the prescribed burning has been done under a canopy of ponderosa pine where a few black oaks were intermixed. However, in one case the brush—mostly nonsprouting manzanita—on a small area of about one-half acre—was pushed over by bulldozer and burned after it was dry. The latest burning before the December storm in 1955 was done in March and early April of that year and on slopes up to 43 percent. The latest burning before the February storm was a few days earlier, February 11, on slopes ranging mostly between 20 and 25 percent (fig. 2). On the areas burned in March and April before the December storm a needle crop of about 1,500 pounds per acre had fallen in September, October, and November. This crop of needles covered about 65 percent of the ground as determined by the point analyzer method. On older burns the needle cover was more complete and nearly 100 percent.

On the area burned a few days before the February storm most of the fresh needles had been consumed by the fire and only the underlying duff and needles that normally remain after prescribed burning were left on the mineral soil. This underlying layer was about one-half inch deep and covered about 95 percent of the ground surface.

In places where surface water ran from trails onto freshly burned areas, the evidence of runoff showed as drifted duff and fine debris. Where the runoff was more severe, particularly where the water came from a wide asphalt road, the duff and pine needles were completely washed aside and the soil surface left bare. These concentrated flows were dispersed after flowing a short distance through duff and needles.

The principal observations of surface runoff and erosion as related to prescribed burning and the other situations described above may be briefly stated and summarized as follows:

1. There was no indication of surface runoff and erosion following prescribed burning that could be related to the burning itself, even after abnormally heavy rains on fresh ash. Also, there was no evidence of runoff on a small area of about one-half acre where the brush had been pushed over and burned after it was dry even though the ground was nearly bare except for ash. Evidence of runoff was observed in numerous places over the forest but in every case its origin was in areas bared by roads, in bulldozer trails, etc., as explained more fully in item 3 below.

These observations are in line with those of Weaver (6) who emphasized that no accelerated soil erosion had been identified as traceable to prescribed burning in ponderosa pine on the Fort Apache Indian Reservation in Arizona.

2. Partially decomposed duff and debris remaining after prescribed burning was effective in maintaining high infiltration and percolation capacity. It must be concluded that the water went into subsurface flow and deep seepage. This is favorable to flood prevention during intense storms.

3. Surface runoff was clearly indicated to have taken place from roads, bulldozed lanes, right-of-way cleared to mineral soil, and bare skid trails running directly down slopes. The surface of bare mineral soil seemed to be sealed by raindrop splash, and in abnormally heavy storms very small bare areas gave rise to pronounced runoff. This would lead one to conclude that great care should be taken in locating and maintaining roads and fire lanes, and in using equipment in ways that bare the soil. Pine needles scattered over a skid trail were effective in protecting the soil against erosion.

4. Results thus far indicate that ponderosa pine stands in this area and soil type can be prescribed burned perhaps every 4 or 5 years and a partially decomposed duff cover maintained, sufficient for high infiltration and percolation capacity and prevention of accelerated runoff and erosion.

5. The main problems in runoff and erosion in such timber covered areas as those described above appear to be connected with practices that give rise to bare soil.

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Effects of Prescribed Burning on Soil Fertility in Second Growth Ponderosa Pine[1] by J. Vlamis, H. H. Biswell, and A. M. Schultz

Prescribed burning may serve as a tool in brush control and manipulation in second-growth ponderosa pine.[2] If so, it is important to know the effects of such fires on the fertility of the soil. Therefore, a study was undertaken to determine the immediate effects of prescribed burning on the nutrient status of soils. Further work is in progress to determine the long-term effects of occasional and repeated burning.

Many aspects of the effects of burning on soil properties are still in a state of uncertainty. One of the more consistent findings relates to soil reaction. It is almost uniformly agreed that burning produces an increased alkalinity of the surface soil (3, 13, 20, 27). A few studies found no significant change in the pH of the soil (4, 19). One investigator found a higher pH as a result of burning on acid soil, but little effect on neutral soils (11).

The influence of fire in increasing the nitrate supply or nitrification in soil also seems fairly well established (2, 6, 12, 21). On the other hand, burning was found to have no effect on ammonification (12), or to decrease it slightly (17).

The base status of the soil, especially with regard to calcium and potassium, is increased following a burn (6, 14). An increase in available phosphate has been found (17), but the preponderant evidence points to no appreciable change in this nutrient (6, 7, 14, 19).

The productivity of the soil as measured by plant growth for the most part has been found to increase for a while, at least, as a result of burning (9, 10, 16, 18, 26). In other studies a decrease was found (8, 28), and in a few instances no change at all has been found (1, 19, 22). One report gave a decrease in growth for some plants and no difference for other crops (24).

PRESCRIBED BURNING

This study originated in connection with a cooperative effort with the California Department of Fish and Game to study the effect of brush removal and manipulation on wildlife populations. Although the research is concerned chiefly with brush control and successions and with game, the work is being done from the standpoint that all wildland resources on an area are interdependent and must be considered together (5).

One of these resources is the soil, and a study of the fertility of the soil as it is affected by prescribed burning forms the purpose of this investigation.

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[1] A portion of this research was done under Federal Aid in Wildlife Restoration Act, Project California W–31–R.

[2] Prescribed burning is defined as the application of fire to land under such conditions of weather, soil moisture, time of day, and other factors as presumably will result in the intensity of heat and spread required to accomplish specific silvicultural, wildlife, grazing, or fire-hazard reduction purposes.

For the past 3 years there has been underway a study of brush manipulation in second-growth ponderosa pine growing on Salminas soil at Hoberg's in the coast ranges of northern California, and on Holland soil in the Teaford Forest near Northfork on the western slope of the central Sierra Nevada Mountains.

The prescribed burning operation consists of two parts. First, broadcast burning is done after rainfall, at a time when the top pine needles on the forest floor are dry, but the duff to the mineral soil is still wet (fig. 1). It is preferable to have a humidity above 25 percent, and an air temperature below 65°. The burning is done downhill, and in the absence of high wind.

Second, cleanup burning is done on the remaining coarse material which is piled as it is burned in small heaps. This phase can be performed under a wider range of climatic conditions than the broadcast burning, but caution must be used in the location of the piles to prevent scorching of surrounding tree trunks. The combustible material consists of needles and leaves, twigs, and debris from conifers and hardwood trees, and dead brush plants such as manzanita (Arctostaphylos spp.) and deer brush (Ceanothus integerrimus) (fig. 2).

Soil samples were taken from areas that had been broadcast burned and also from places where dead brush and other debris had been piled and burned, referred to hereafter as light burn and heavy burn. A control sample was collected from an adjacent unburned area. The soils were collected from areas which had been burned 1 year and 2 years previously. Each soil type and treatment was sampled in triplicate.

After the remaining litter and ash were swept aside, the mineral soil was sampled at 2 depths, the top 8 inches, and the next 8 inches. The soil was transported in burlap sacks to Berkeley where it was assayed in the greenhouse for fertility by means of a pot testing technique.

DESCRIPTION OF SOILS STUDIED

The Holland soil from the Teaford Forest in the Sierras is a sandy loam formed in place on weathered granitic rocks. It is slightly acid and occurs to a depth of 2 to 3 feet with a slight profile development. The acreage is extensive in the Sierra Nevada foothills, the Coast Range, and the mountains of southern California (23).

The Salminas loam from Hoberg's in the coast ranges is formed in place from andesite rocks. It is moderately acid and has a depth of 3 to 4 feet with very little differentiation in the profile. This soil has not been mapped extensively as yet, but with closely allied soils such as those of the Aiken series, a large acreage is found in the mountains of the coast ranges and the foothills of the Sierra Nevada Range.

POT TEST OF SOIL FERTILITY

The pot test is performed in a greenhouse and has been used for several years in California to study the nutrient levels of agricultural soils (15). The greenhouse results have been correlated with field trials so that it is useful in practice to estimate the field needs of soils for fertilization. This correlation may not be applicable to soils supporting forest trees, but the method may still provide a useful index in appraising relative changes in soil fertility induced by certain treatments such as prescribed burning.

About 4 pounds of soil are weighed into 6-inch pots, and this serves as a check. A complete fertilizer treatment is then set up containing nitrogen, phosphate, and potash. In subsequent treatments one of these nutrients at a time is omitted so that the supplying power of the soil for each element is tested in the presence of adequate amounts of the other two. Lettuce and barley are planted in separate pots, and after 6 weeks of growth, the plants are harvested and the dry weights are recorded. The lettuce is planted as seedlings in triplicate pots with 1 plant per pot and the barley is planted as seed in duplicate pots to produce 5 plants per pot.

RESULTS OF THE POT TESTS

The dry weights of lettuce and barley plants grown in the pot tests of the Holland soil (0 feet 8 inches) are given in figure 3. The tests were made on three different soil samples taken from each field plot.

The results from the control sample which received no burning treatment in the field indicate that the soil originally was quite low in nitrogen and phosphate, but adequate in potash. The yields from the complete fertilizer are fair compared to those obtained from agricultural soils tested in the greenhouse at

the same time. The unfertilized pots gave very low yields of lettuce and barley, reflecting the low N and P status of the soil. The relations indicated above applied equally to the subsoil samples (table 1).

TABLE 1.—*Lettuce and barley yields from Holland soil sampled 1 year after burning (8- to 16-inch soil depth)*

[Average dry weights in grams per pot]

Nutrient treatment	No burn		Light burn		Heavy burn	
	Lettuce	Barley	Lettuce	Barley	Lettuce	Barley
$N_0P_0K_0$	0.2	0.4	0.6	0.5	0.6	1.3
$N_1P_1K_1$	2.7	2.6	2.4	2.2	3.0	2.7
$N_0P_1K_1$	.4	.5	.9	1.0	1.4	1.3
$N_1P_0K_1$	.2	.6	.5	1.5	1.1	2.5
$N_1P_1K_0$	2.5	2.0	2.3	2.0	2.9	2.4

The soils from the heavy burn plots showed a substantial increase in both the nitrogen and phosphate supplying power of the soil from the surface 8 inches, and a more modest increase in both these nutrients in the subsoil compared to the control soil from the no-burn plots. No change was detected in the potash supply, and this is due to the fact that this nutrient was already adequate in the control soil. Under these circumstances a potash change would be demonstrated more readily by a chemical analysis of the soil rather than by a growth test. There was no significant change between the yields of the complete fertilizer, but there was a sizable increase in the check pots, reflecting the increased nitrogen and phosphate supply in the heavy-burn soil.

The light-burn soils showed an increase in nitrogen and phosphate which was intermediate between the no-burn and heavy-burn treatments.

These results were obtained on soils collected 1 year after burning. In order to determine the duration of the nitrogen and phosphate responses, similar pot tests were made on soils which had been burned 2 years previously. The data obtained from this test are shown in table 2. The increase in nitrogen and phosphate was considerably smaller than had been found on the 1-year burns.

TABLE 2.—*Lettuce and barley yields from Holland soil sampled 2 years after burning*

[Average dry weights in grams per pot]

0 TO 8-INCH SOIL DEPTH

Nutrient treatment	No burn		Light burn		Heavy burn	
	Lettuce	Barley	Lettuce	Barley	Lettuce	Barley
$N_0P_0K_0$	0.1	0.4	0.5	0.5	0.1	0.6
$N_1P_1K_1$	2.9	2.8	2.4	2.2	2.7	2.5
$N_0P_1K_1$	.6	.5	1.3	.6	.6	.6
$N_1P_0K_1$	.2	.6	.3	1.1	.1	1.1
$N_1P_1K_0$	2.6	2.7	2.4	1.8	2.7	2.3

8- TO 16-INCH SOIL DEPTH

$N_0P_0K_0$	0.2	0.4	0.2	0.3	0.3	0.4
$N_1P_1K_1$	2.7	2.6	2.7	2.9	2.6	2.5
$N_0P_1K_1$	.4	.5	.7	1.0	1.0	1.1
$N_1P_0K_1$	.2	.6	.2	.6	.1	.7
$N_1P_1K_0$	2.5	2.0	2.6	2.8	2.6	2.1

The burn plots of the Salminas soil were also sampled and the soils tested for nutrient response. The results appear in figures 4 and 5, and they confirm the increase in nitrogen supply found in the Holland soil as a result of burning. On the other hand there is no appreciable increase in the available phosphate as had been found on the previous soil. This contradiction in the phosphate supply

of the two soils serves as a good example of the varied results which have been reported with respect to many soil responses as a result of burning.

A possible explanation of this phosphate discrepancy may be found in the nature of the two soils. The Salminas soil is a phosphate-fixing soil that ties up large amounts of phosphate which are not readily available to plants. The Holland soil does not fix phosphate to such a large extent and much of the phosphate that is added to it is available to plants.

In order to test this hypothesis a laboratory test was made. Known amounts of phosphate were added to samples of soil taken from the surface 8 inches. After an incubation of 24 hours at room temperature, the availability of phosphate was measured by means of the Truog chemical test (25). This method has been found reliable in measuring the availability of phosphate in soils as related to plant response.

The data obtained are given in figure 6. They show that when various amounts of phosphate are added to the Holland soil, the amount of this nutrient extracted rises sharply with the amount added. On the other hand, the Salminas soil fixes large amounts of phosphate, so that at the low levels of this compound added there is just a small amount available. Only when the applied phosphate reaches 300 pounds per acre does the availability reach a high value.

Interpreting this in terms of prescribed burning, the explanation may be offered that assuming equal amount of phosphate are added by the combustion of organic matter on the two soils, the Salminas soil ties up a large fraction of this substance, while the Holland soil leaves it available for plant growth. This would explain why the Holland soil showed a substantial increase in phosphate supply, while the Salminas soil showed very little change due to prescribed burning.

DISCUSSION

The increase in available nitrogen found in these soils as a result of burning is in agreement with previous work done largely by chemical analysis and occasionally by crop growth. In addition, the burning treatments showed a large increase in the available phosphate supply of one soil and no significant change in the other. The phosphate situation has not been as fully explored by previous workers as has the nitrogen effect, and in a majority of the investigations no significant change in phosphate had been found. In this study the different phosphate responses of the two soils are explained on the grounds that one of these soils fixes phosphate to a high degree and reduces the amount available to plants especially when the phosphate added is not very large.

The data obtained in these experiments are the result of a controlled type of burning performed in a prescribed manner. However, this being a field operation, there is necessarily a wide latitude in the execution of the recommended procedure for burning. This may in part account for the greater variability shown by the pot tests than would ordinarily be expected in a greenhouse or laboratory study.

Likewise this may be a major reason for the great divergence of opinion in the literature as to the effect of burning on certain properties of the soil. In other words, the differences in type and amount of vegetation, intensity of burn, intensity and frequency of rainfall, other climatic factors, and the nature of the soil, may add up to give results which will vary with the circumstances. Once these conditions are defined it may be possible to anticipate this or that effect as a result of forest or brush burning.

SUMMARY

A study was made of the effect of prescribed burning on the fertility of two soils in widely separated areas.

Soil samples were collected at 2 successive depths of 8 inches from 2 forests of ponderosa pine. Two intensities of burning were studied, a light burn from an area burned broadcast, and a heavy burn at a spot where debris had been piled during burning. Unburned soil samples were also collected for purposes of comparison.

The soils were assayed for soil fertility by means of a greenhouse pot testing procedure to determine the nitrogen, phosphate, and potash supplying power of the soils.

The unburned soils assayed low in nitrogen and phosphate as measured by the growth of lettuce and barley. The potash supply was adequate, so this precluded any measure of changes in this nutrient by the method used.

The heavy burn soils showed an increased nitrogen supply over the light burned, and the latter over the unburned soil. The effect was greater in the surface soil than in the subsoil. The results were less pronounced on the 2-year burn than on the 1-year burn.

One of the two soils showed a marked increase in phosphate as a result of burning. The other soil showed no significant change in the phosphate supply as a result of burning. It was suggested that this discrepancy in phosphate response might be due to the tendency of one of these soils to fix large amounts of phosphate, so as to make it unavailable for plant growth.

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SEEDLING GROWTH ON BURNED SOIL—EFFECT OF PRESCRIBED BURNING ON SOIL FERTILITY REFLECTED BY THE GROWTH OF PINE SEEDLINGS IN STUDY OF NUTRIENT RESPONSE

(J. Vlamis,[1] H. H. Biswell, and A. M. Schultz)

Ponderosa pine seedlings were used in a study of soil-fertility changes induced by prescribed burning to learn whether nutrient responses would be reflected by a crop natural to the soil.

The pine seedlings were grown in 10-inch pots—5 plants to a pot—for 1 year on a forest soil which had been prescribed-burned. Other seedlings were grown in soil from unburned sites as a control. The soil in the tests was a Holland sandy loam from about 3,500 feet elevation in the Teaford Forest in Madera County. The Holland series extends widely along the Sierra Range, on basic igneous rock formations, where the rainfall averages between 25 and 40 inches annually.

The hot or spot burn—produced by piling dead brush and fallen trees on small spots and burning for several hours—was the only condition of prescribed burning used for the tests. After sweeping the charcoal and ashes away from the centers of burned spots, soil samples were taken from the top 10 inches and composited for the pot test.

A previous study on the same soil using indicator plants—lettuce and barley—showed that the lightly burned soil was intermediate in nitrogen and phosphorus supply power between the hot burn and no burn. The lightly burned condition is produced by broadcast burning the upper dry portion of the needle and duff layer while the bottom is moist.

The pot-testing method involves five treatments. A check, with no nutrients added, measures the fertility of the soil as it was sampled in the field. The complete treatment has nitrogen, phosphorus, and potassium added. Following the complete treatment, each element is omitted in turn to test the nutrient supplying power of the soil when it is adequately supplied with the other two. Each treatment is replicated three times.

The pine seedlings grown on the burned soils showed nearly 50 percent increase in weight over the seedlings in the control—no burn—pots. This was true for the check—unfertilized—pots as well as those with different fertilizer combinations and omissions. Three other measurements of the seedlings showed the same relative differences. These were height to the growing point, stem diameter, and number of lateral branches.

The effect of prescribed burning on the available nitrogen gave responses in the pine seedlings similar to those obtained by the standard-indicator plants. The tree seedlings did not respond to phosphorus whereas lettuce is very sensitive to this element. Consequently the additional phosphorus made available by burning does not make the five to tenfold difference to the pine seedlings as it does to barley and lettuce.

The CHAIRMAN. Thank you, Professor. Will you stand by, please, until after we have heard these others, so we can ask questions?

Prof. A. W. Sampson, professor of forestry emeritus, School of Forestry, University of California, Berkeley, Calif.

We are very glad to have you here, Professor Sampson. You may either summarize your statement or read it.

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STATEMENT OF A. W. SAMPSON, PROFESSOR OF FORESTRY EMERITUS, SCHOOL OF FORESTRY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.

Mr. SAMPSON. Mr. Chairman and members of the committee, and guests, ladies, and gentlemen, this assembly, called together by the Honorable Congressman Clair Engle to consider administrative needs in the management of brush fields and watersheds, seems to me to be particularly timely. It is good to occasionally size up what we have been doing and where we are going, to make proposals also as to how the watersheds might best serve the communities and the valleys below.

I am sure that everyone living in the valleys wishes to have as much water available for crops as possible.

With these thoughts in mind, I shall touch on a few pertinent facts which are focused essentially to southern California brush fields.

First, however, I wish to make a very brief statement in regard to Indian burning since it has already been mentioned by the speaker just before me.

Did the Indians burn the wildlands each year in the fall, as many claim? Did they do this extensively? And did it result in lack of serious fires?

Many persons believe that the Indians burned everything that would ignite in the fall of the year when they left the forests.

My study, based upon conclusions of anthropologists and early explorers, indicates that Indian burning was limited and selective. Mostly the burning was done on small units to drive out deer, perhaps to facilitate hunting the following year. It was done to facilitate the gathering of seed for food, to foster the production of berries, and, indeed, even to roast grasshoppers. I am told that country grasshoppers with a glass of beer is a very delectable morsel.

We should keep in mind that kindling of fire requires considerable energy, and the Indians were innately lazy. For the same reason, it is not likely that the Indians tried to put fires out. In the first place, there was no inducement; they had no equipment; they had no land to manage.

We should also remember that the Indian population in California amounted to only about 133,000 when the white man arrived here, and, of this number, approximately 50 percent lived on the coast and they were fishermen. About 38 percent inhabited the valleys, and the remaining 10 or 12 percent found their way into the brushlands and the mountains during the warmer part of the year.

But whether the Indians burned much or little will never prove the efficacy of using fire to prevent fire. That phase is unconsequential so far as our present management program is concerned. It is similar to trying to prove the soundness of a farm fertilization program by trying to show that the Indians planted a fish under each hill of corn.

Those who advocate a program of annual burning to prevent wildfires believe that this is logical, and they assume that the Indians thought so, too.

Getting back now to where we are here in southern California, one of the most common images that we get when we think of chaparral is a cover of shrubs and low trees, often with very little understory vegetation, occupying rugged terrain. Many visualize merely a pure

chamise or scrub oak stand, but there may also be an admixture of manzanilas, ceanothi, buckthorns, and many other such species.

We note, too, that the elevation where these brushlands occur is areas lie in relatively low-rainfall areas, areas between, say, 10 and 25 inches of rainfall per year.

We note, too, that the elevation where these brushlands occur is from about sea level up to about 5,000 feet.

Now one of the questions that is foremost in the minds of those who propose manipulating the brush, say clearing it for some other purpose, growing of grass or whatever it may be, is: Is this particular brush field of a sprouting form or is it of the nonsprouting type?

If it is of the sprouting form, you have a brush cover that is very difficult to kill, because a short time after the fire, the first year after, there are a lot of sprouts, there are many seedlings, and you have to pass on your job again to control the woody vegetation.

The sprouting vegetation is a true fire type, and it grows on relatively thin, inferior soils where it forms a pretty stable cover.

On the other hand, the nonsprouting brush is killed by a single hot fire. But one again has seedlings here to contend with, but they can be controlled more or less easily.

Now here is a question of great importance to us in southern California: How severe is soil erosion in this general area?

This region is set off from the rest of the State by a number of conditions which favor severe erosion.

The soils are predominantly of granitic origin. They are loose, gravelly, or sandy, they are readily carried down the slopes when the soil is exposed to the elements, such as after a fire.

When suddenly exposed to wind and rain, they are very erosive in general. The steeper the slopes the greater is the erosion—I am speaking in generalities—especially the first year that the soil is exposed. And the rainfall here in this region tends to be sharp and slodges a great deal of the soil.

In many localities large ranch areas have been gullied and covered over with floodwaters deposited after sharp rain and coming from newly burned areas. Those are the areas that give the rancher a great deal of trouble.

Sediment measurements support the belief that slopes steeper than about 30 percent should be left intact, especially where the soil is thin and subject to severe erosion. A large area of our brushlands are on soil much steeper than 30 percent.

If it were possible to convert brush to grass, would the yield of usable water be increased?

I suppose we can call that the $64 question. It is a question that cannot be answered very accurately at this time because of insufficient research effort. We know, however, that an efficient watershed is well covered with vegetation of some kind. We know, too, that a grass cover with its shallow, fibrous roots binds the soil well. Likewise, a dense brush cover provides good watershed protection.

It is generally accepted that the amount of water transpired by vegetation is roughly proportionate to the volume of green active tisseu per unit area. My own studies have shown that somewhat higher soil moisture occurs below the 4-foot depth of soil on areas that have recently been burned.

Say they were burned this year and they had a volunteer cover of annual grasses and brush seedlings. Therefore, the first 3 years we get a measurable increase in moisture, beginning at about the fourth foot of depth. After that there is practically no difference. The brush is back in, there is more grass, and then we get, oh, so many more weeds which have deep roots, and they pump a lot of water out of the soil. So we have lost our advantage by about the end of the third year.

Now these facts are further substantiated by studies by the California Forest and Grazing Experiment Station where they found that soils 4 feet or deeper did show a differential in favor of the grass cover up to and past the third year after burning, and after that, because of other vegetation coming in, more deep rooted than the grass itself, late weedy vegetation, there was again no difference. So that seems to be a fairly solid thing to lean on.

I would not hesitate, however, to state that, if we can convert heavy brush cover to grass and maintain it indefinitely, we would or should expect to get more water than when we had the brush cover.

It is hardly necessary to remark that it is extremely important to reestablish a plant cover as soon after a fire has gone over these brushy areas as we possibly can.

In southern California some of the flow after a fire has been bulked by from 10 to 25 percent of silt. That is, the total volume that came down amounted to 10 to 25 percent in silt alone.

What happens when that material is lodged on private land or in irrigation canals? It is a very serious thing.

A word now in regard to research needs.

I was very pleased to hear this morning favorable comment in regard to that sort of thing, but we can see that in the light of our present rather limited knowledge of effective means of suppressing fires and of securing better watershed management, more efficient management of the watersheds, it is very important indeed to learn all we can about this, and the only way we can do that is by setting up research projects.

Adequate funds should be provided at a minimum delay in time to develop, as I see it, five fields of closely related wild land studies.

One of these is a study by chemists and plant nutrition experts of the soil itself. We have at the present time a very useful soil vegetation survey, but if we could find out more about each type of soil than we know now, that survey would be infinitely more valuable.

Is this soil a good brushland soil? That is, will it produce indefinitely brush that will maintain the watershed? Is it a good grassland soil so it can be converted into grass instead of brush?

A second point is basic plant research, including: Are fires heavier in various screen-growing vegetation?

It is my understanding that there is a good deal of difference as to whether this cover of green vegetation will burn readily at almost any time of the year versus another type of brush. The difference is considerable, and we should know much more about the flammability of the different types of brush in their green state.

We also should be prepared, if this should prove feasible, to replace our more flammable brush type by vegetation that is not nearly as

flammable. We can perhaps find brush species that are hardy, that are aggressive, that could replace our present brush cover. It is going to be expensive, but there may be a place to do that, and basic plant research is the place where that should be found out.

A third is basic hydrology, hydrologic watershed research. This should be greatly expanded to include studies of manipulating various types of brush to see if a greater yield of water could be obtained. This would be a long-time study and it calls for the time of scientists covering the physical and biological fields, hydrology and other phases.

A fourth point is the basic fire-control studies. This should include further investigation of fire-behavior patterns, fog-blanket information for fire control, and an improved chemical fire retardant substance.

There has been good work on all of these, but they are in their infancy. We need much more work along this line.

We must avoid, incidentally, use of poisonous sprays which may be carried down into the valley to raise havoc with the crops down below. We know that that has happened in a way, and measures have been taken to correct them, but it is a very important subject.

Then the fifth research program, if we may call it that, is administrative experiment with fire control, and this is a field that has received almost no attention that is very much needed.

This should include the feasibility of the use of fire at suitable times, whatever time that might be, the winter or early spring. And it should, especially, look into the matter of using the area-ignition fire method of control.

The area-ignition fire system has been developed by the California Forest and Range Experiment Station, and it provides for the starting of many large fires within a given area in such a way that the fire burns toward the center and literally puts it out.

That type of control burning, broadcast burning, it seems to me, could be particularly well adapted to a program for getting rid of brush in critical areas.

In conclusion, I wonder if many of us here realize that the funds now provided for basic fire and watershed research are but a fraction of the amount spent each year for fire suppression. I do not know if I dare say it amounts to 1 percent of that total fund, or even less than that. It is dreadfully small. Yet it is only through research that these expenditures can be effectively lowered; that is, the administrative research.

I seem to recall, in this connection, a little story of the lady who made her first trip to California from the East, and she found herself in an orchard this particular morning. She asked the party there, "What tree is this, anyway? I never saw a tree like this."

"Madam," he said, "that is a fig tree."

"Oh, no; you are wrong this time. The fig leaves have to be much bigger than that."

So it is. We must be sure of our grounds before we draw conclusions that are none too solid.

Thank you.

(The prepared statement submitted by Mr. Sampson follows:)

STATEMENT OF ARTHUR W. SAMPSON[1] RE SUGGESTIONS FOR FIRE PROTECTION AND WATERSHED MANAGEMENT IN SOUTHERN CALIFORNIA[2]

Because of the increased awareness by the public generally regarding protection or loss of our natural resources from fire, floods, and soil erosion, it seems appropriate to reappraise this important subject. Many ask, "How effectively are the wildland resources being protected from damage by fire? Are the watersheds yielding a maximum supply of usable water? How effective are the wild-land research organizations in perfecting better fire-control and watershed-management improvement? What is needed—in research and administration—adequately to protect our natural wild-land resources?"

Because of the magnitude and diversity of these problems, I shall confine my consideration to California—indeed, essentially to southern California—where fire control and watershed management are most critical.

GENERAL CONSIDERATIONS

When we think of the southern California brushlands, we picture areas of shrubs or small trees, often with little understory vegetation, occupying hilly or rugged terrain. We may visualize a cover of nearly pure chamiso or scrub oak or an admixture of these with manzanitas, ceanothi, buckthorns, buckwheats, bush monkey flower, globemallow, salvia, and various woody composites. We will also note that these lands characteristically have relatively thin rocky soils and are located in the low to moderate rainfall zone (approximately 10 to 30 inches annually) between elevations of from near sea level to about 5,000 feet. These lands pose many challenging management problems, only a few of which have been clarified through research.

This paper will discuss a few of the questions that are often raised by persons interested in water yield, fire protection, and forage improvement. It will also touch on the status and needs of research in these fields.

Before accepted management principles can be effectively applied to a specific brush field, we find ourselves asking questions such as the following:

1. Is brush of this region the most stable or permanent cover that the land can support if left undisturbed? If a fire runs through it occasionally, will brush soon again reclaim the land?

2. Did the Indians of California burn the brush fields and forest lands extensively? If so, what effect, if any, did this have in decreasing or increasing the brushy vegetation and in indicating how devastating forest fires might be minimized?

3. Are the stands composing a particular brush field made up of sprouting or of nonsprouting species, or a mixture of both? The answer to this question is germane to the techniques to be employed in brush manipulation or control.

4. Are the soils occupied by brush of this region subject, in general, to severe erosion when exposed to rain and wind, as often occurs after burning?

5. Will watersheds yield larger or smaller amounts of usable water if the brush cover is replaced by grass? Immediately? In the long run?

6. Are the soils occupied by brush generally productive enough to support a good grass cover when cleared? Permanently? Temporarily?

I shall endeavor to answer these questions as briefly as possible.

1. Stability of the brush cover

The chaparral, as well as the coastal sagebrush, and most other woody covers of southern California, is so well adapted to the climate and soils as to form the most abundant and persistent components in essentially all successional stages. Chaparral, in particular, competes successfully against grass and forb invaders in all developmental stages and emerges as the climax or most permanent cover. Chaparral species are deep rooted and drought enduring. In late summer, when soil moisture may be at or below the wilting point, these plants pass into a state of virtual dormancy. It seems fortunate that the chaparrel survives on those severe sites, for it provides verdure and needed

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[2] Prepared for presentation at a conference proposed by the Honorable Congressman Clair Engle on policy pertaining to fire-protection and watershed problems as applying particularly to southern California.

protection of the soil and watersheds. The chaparral cover is one of the best and easiest types of cover to maintain for the protection of steep mountain slopes.

In contrast to the stability of the brush cover in southern California, as mentioned, perennial grasses and forbs tend to replace the chaparral on certain undisturbed soils in the northern counties, where rainfall is heavier and the summers less warm. Intermitten fires favor brush invasions everywhere, but, on better sites in northern California, long protected from fire, perennial grasses tend to replace the brush as it becomes decadent.

2. Indian burning of brush and forest lands

Various well-meaning persons have proposed control burning to reduce the brush and litter fuel on watershed lands, and to aid in wildfire prevention and suppression. They state that control burning would protect the merchantable timber, yet they have no support for this statement other than claims that the Indians frequently burned the forest and brushlands and thus protected their habitations from destruction by fire. Others claim that Indian burning was confined to small areas in timber and brush to drive out game and attract deer to the area the following fall, to roast grasshoppers, facilitate the gathering of seeds and berries for food, and to clear land for planting of corn and tobacco.

Because of these differences of opinion, I reviewed the leading documents on the subject and published the findings in 1944 (9). I also consulted with Prof. A. L. Kroeber, then head of the department of anthropology, University of California, Berkeley, who devoted many years of study of the culture and habits of the California Indians. His 1,000-page book (7) on the Indians of California is a recognized standard work on the subject.

The facts which I assembled indicate that Indian burning in California was restricted by both the small Indian population—totaling about 133,000 when the white man arrived—and by the Indians' mode of life. Forty-six percent of the total Indian population was located along the coast, where fish provided food year long, 42 percent inhabited the valleys, and only 12 percent lived in the intermediate elevations and mountains—the area with which we are here most concerned.

The Indians evidently used fire frequently to clear land for various purposes. Kroeber concluded that "the Indians burned in both the open country and forests. The firing was not indiscriminate but was limited to certain tracts or spots in which they were interested. * * * If they fired the chaparral occasionally, it was usually with the idea of driving the game out."

Burning in the chaparral was evidently so restricted as neither to keep the brush down nor to extend or restrict its distribution. The fact must not be overlooked that kindling a fire entailed considerable effort and that the Indians were innately lazy.

Whether or not the Indians burned the brush and forest lands limitedly or extensively will never prove the efficacy of using fire for hazard reduction. The argument is similar to attempting to prove the soundness of a farm-fertilization program by establishing whether or not the Indians actually planted a fish under each hill of corn. Proponents of burning with the view of keeping the cover open feel their ideas are logical, and they assume that the Indians thought so, too.

3. Sprouting and nonsprouting brush species

The chaparral is composed of two contrasting growth forms—nonsprouting and sprouting species. The nonsprouters generally are much heavier seed producers than the sprouting forms. These characteristics of sprouting and of heavy seed production would seem to account largely for the persistence and dominance of the chaparral on low-quality sites. Sprouting species outnumber the nonsprouters and occupy much the larger acreage.

In sprouting plants, such as buckthorn, bush monkey flower, ceanothus, chamise, manzanita, salvia, scrub oak, sumac, and many composites, the buds of the root crowns remain dormant until the top growth is removed, as by chopping or burning. In a few weeks after such removal, numerous vigorous sprouts arise from the crown near the ground line. Since fire does not injure the roots the sprouts grow rapidly so that in a few years the stand is as dense as before the fire. This peculiarity, in addition to the fact that great numbers of brush seedlings invade opened-up brush areas, has given rise to the term "fire type" for the chaparral. A few years after a fire the brush often becomes denser than before the area was burned.

Fields supporting nonsprouting species, on the other hand, can usually be opened up without too great difficulty, but the large numbers of invading seedlings must be controlled. Nonsprouting chaparral tend to occupy the better brushland sites.

4. Severity of soil erosion in southern California

Southern California is set off from the rest of the State by a number of conditions that differ markedly from those in the northern area. The more conspicuous differences are:

(*a*) The geologic or normal erosion from the common soils of granitic origin in southern California mountains averages annually about 1½ acre-feet per square mile as compared with 0.4 acre-foot per square mile on the dominant soils of sedimentary rock in the northern mountains. This high rate of erosion under undisturbed conditions in the mountains of the southland is clearly indicative of the high degree of accelerated erosion to be expected, and which actually occurs when the soils are suddenly exposed to wind and rain as by burning. Soils so unstable under a climax cover are subject to extremely severe erosion when the land is bare.

(*b*) The shrub-covered soils of the southern mountains are mostly young in terms of degree of weathering and development. They are commonly of rather loose gravelly or sandy nature and of shallow or very shallow depth, and they tend to erode readily, particularly on the steeper slopes which are not adequately protected by vegetation. This severe erosion begins immediately after an area has been burned bare, even without rainfall. Erosion by dry creep of the soil occurs over extensive areas where the mountain slopes are in excess of about 65 percent, the angle of repose.

(*c*) Rainfall in the southern mountains tends to be more intense and causes much more erosion than in the northland. A rainstorm of 0.5 inch in the southland, for example, might cause more erosion than a much greater storm in the northern mountains.

(*d*) There are more extensive areas of extremely steep-sloping soils in southern California than in northern California within the chaparral zone.

The erosion that most concerns the southland rancher and city dweller is most serious in freshly burned chaparral lands after a sharp rain. Surface flow and soil movement on slopes may be increased several hundred percent for the first 3 years after burning; but from then on, as vegetation regrows, both overland runoff and erosion return to relatively low, near-normal values. Plot studies have shown that in some localities erosion was much heavier than in others. For example, on some plots denuded of vegetation, with slopes as high as 70 percent, erosion was negligible. On other plots, on the same area, with no more than 15 percent slope, erosion was so heavy as to severely damage the land the first year after denudation. In many localities large ranch areas have been badly gullied and much detritus has been deposited on the flats by floodwaters.

In addition to the factors setting off the soil-erosion problem in southern California is that of a heavy population with a large property investment at the very foot of steep mountain slopes whose main protection against erosion is the chaparral cover. A storm such as the one of New Year's 1934 at La Crescenta in the Los Angeles River watershed might cause an equivalent amount of debris to be dumped in an area in western Tehama County, for example, but with hardly any notice by the local residents because of the small population and comparatively low property values.

Various studies have shown that chaparral and its understory vegetation protects the soil from abnormal erosion, and that this cover favors relatively high infiltration of rainfall, thereby reducing overland flow and erosion. Sediment measurements and extensive observations support the conclusion that the chaparral on slopes steeper than about 30 percent should be left intact, especially where the soil is thin and highly erodible.

5. Usable water yield from grass in contrast to brush cover

An effective watershed is well covered with vegetation for soil surface protection, yet excessive amounts of water are not always needed or used for its maintenance. Satisfactory soil-plant relations provide maximum stability of the soil, and maintain a favorable structure of the surface soil for water infiltration. No watershed will yield the maximum flow of clear, usable water if an abnormal rate of erosion is taking place.

A complete grass cover, with its large volume of shallow fibrous roots, binds the soil remarkably well, and the top growth breaks the force of wind and rain.

Dense brush also affords good watershed protection, but some kinds of brush plants are more effective than others. Broad-leaved brush species, like the manzanitas, salvias, sumacs, and scrub oaks, largely because they form an abundant leaf litter and decrease the impact of raindrops, afford better soil protection than do narrow-leaved shrub stands, like chamise and deerweed, with their relatively small volume of leaf fall. However, the fact should not be overlooked that over extensive areas where no other plants seem to be able to grow, unburned chamise is effective in binding the soil and in greatly minimizing erosion.

It is generally accepted that the amount of water transpired by vegetation is roughly proportionate to the volume of green active tissue per unit area. My own studies (10), for example, showed somewhat higher moisture content below 2 to 3 feet of soil depth on recently burned chaparral soils stocked with a sparse cover of volunteer annual grasses and young brush sprouts and seedlings. In the fourth year, as the brush gradually reclaimed the site, this differential in soil moisture was lost.

Since the top growth of a dense grass stand is usually much less than that of a corresponding cover of brush or trees, one would expect the grass to utilize less water throughout the year. This assumption is apparently correct; however, the smaller amount of water used by a grass cover may be more or less offset by interception because of grass having so much surface area in proportion to its size, and its many hairy surfaces to catch and hold water. Kittredge (6) reports interception losses from grasses of 26 to 33 percent of the seasonal rainfall of 33 inches in Berkeley, as compared with 3 percent loss by chamise in southern California. Neither figure was corrected for stemflow. At Northfork in Madera County, and at the San Dimas experimental forest, Hamilton and Rowe (4) found that a maximum of 14 percent interception loss occurred in mixed chaparral under spring-summer conditions when the deciduous species were in full leaf.

Results of these studies showed that stemflow is an important factor in the interception process, for the quantity of water reaching the soil by this means is relatively large. In these studies the average annual stemflow for all sites averaged 7½ inches, or about 20 percent of the total rainfall. Since intercepted stemflow is delivered at the base of the shrubs at a slow steady rate where the infiltration capacity is high, it adds significantly to soil moisture.

Water-yield measurements recorded on brush-converted annual ryegrass plots in the mountains of southern California by the California Forest and Range Experiment Station brought out three significant points:

The first was that water loss from grass as compared with brush-covered soils less than 4 feet deep would be about the same. On such sites little or no additional water yield would result from converting the cover from brush to grass. On sites with soil deeper than 4 feet, more water would result from grass-covered soils in years of rainfall sufficient to wet the soil below this depth, but only if invasions of summer-growing broad-leaved herbs and grasses are controlled. Frequently such invasions are heavy.

The second was a greater carryover of water at the end of the first 3 summers in the 4- to 12-inch depth of soil under the grass plots than under the undisturbed brush plots.

In any event, such a saving in water is more apparent than real, for only a small part of the shrub-covered wildland area has soils more than 3 or 4 feet deep.

The third was that after the third summer when the grass cover had been invaded by deep-rooted native or naturalized grasses and forbs, the soil throughout the 12-foot depth was nearly as dry under the grass as under the brush.

The fact must not be overlooked that annual ryegrass and other annual grasses can seldom be fully maintained beyond the third year after seeding. If perennial grasses are employed the evapo-transpiration loss would probably be much the same as where the soil is brush-covered because perennial grasses have deeper root systems and a longer seasonal growth cycle than annual grasses. If perennial bunchgrasses are planted, severe sheet and/or gully erosion might take place because of incomplete surface coverage formed by such plants. Also deep-rooted forbs would readily invade the site, thus perceptibly reducing moisture in the lower soil depths.

The importance of reestablishing a vegetal cover soon after burning or otherwise clearing a watershed was impressively demonstrated by Hoyt and Troxell (5) in the San Gabriel Mountains of southern California. For several years before burning one of the watersheds, streamflow was measured on the two watersheds in order to calibrate their flows.

Peak flows were measurably increased on the burned watershed during storms. However, the larger surface flows, with their heavy charges of sediment after each sharp rain, as reported by these workers, raises much doubt that usable water yield was increased by the burning. More than 95 percent of the increase in discharge, according to Lowdermilk (8), occurred during the rainy season. Surface flow is much less usable than ground-water flow as muddy water cannot be handled on the spreading grounds that are used to replenish the underground basins. Thus a large proportion of the storm flow from burned areas is likely to be wasted in the sea.

Despite the characteristic accelerated erosion on denuded areas, there may be particular watersheds where surface flow from a burned area might be usable. An example would be the Vista Irrigation District watershed in San Diego County, with a reservoir of such large capacity that it has never filled in 35 years. In such instances the risk of excessive accelerated erosion on productivity of the watershed land must be carefully weighed against the expectancy of additional usable water.

One factor overlooked by Hoyt and Troxell in their consideration of "increase in water" was that, despite the high amount of sediment in the water after the burn, it was not subtracted in determining water yield. Some of the flows were bulked 10 to 30 percent with ash and sand. (See Hoyt and Troxell, table 12.)

Although a grass cover may account for a somewhat larger carryover of soil moisture than brush below the 3-foot depth, such water accumulation would be confined to soils having a deep profile. Moreover, it must be borne in mind that this carryover of moisture reduces the amount of seasonal water the soil can store, thus it would not aid flood control to the fullest degree. The fact must not be overlooked that a bone-dry soil mantle is one of the best flood-control reservoirs—provided the infiltration capacity of the soil is unimpaired.

Reestablishing and maintaining a cover as soon as possible after clearing is highly important. Where this cannot be done with certainty, as on steep slopes of thin soil, the natural cover should be left undisturbed.

6. Possibilities of converting brush cover to grass

Grass can be established—and in some localities maintained—on various brushland soils where rational management is applied. Generally, however, grass cannot be maintained on the more inferior brushland sites by presently known methods of management. As a general guide, the soil should average no less than about 18 inches in depth, and the more severely exposed shallow soils on south and west slopes in the low rainfall areas should be left undisturbed. A large proportion of the brush fields of southern California occupy soils less than a foot in depth and are therefore incapable of being measurably improved for grazing by planting grass.

Much of the controversy that arises over the management of chaparral lands can be traced to the various parties to the argument having in mind different situations—of soil, of vegetation, of topography. Because of these disagreements, I have recently estimated the degree of success of grass establishment over the State as a whole on control-burned areas, some subsequently seeded under the technical guidance of the State division of forestry, and others left unimproved. The areas sampled by the range technicians were segregated into five production grazing capacity classes and the results expressed in acres per animal unit months (A. U. M.). The class designations were: "Very good," "good," "fair," "poor," and "very poor." The sampling was heaviest in southern California.

The survey revealed that on the 20 million acres or so of foothill brushland seeding after burning would no more than permit the stockmen to break even financially on more than 9 million acres, the remaining 11 million acres being too poor for reseeding. Even on a large proportion of this 9 million acres only poor or ephemeral stands of grass could be established. According to this analysis, not more than about 3 million acres appear to have "very good," "good," or "fair" potential for grass establishment and maintenance.

To locate and properly appraise these so-called better areas is a first step—a must, let us say—in brushland and watershed management. Such a basic procedure would call for a greatly enlarged soil vegetation survey program as compared with that currently conducted so effectively by the California Forest and Range Experiment Station in cooperation with the State division of forestry and the University of California.

Before any brush clearing is undertaken decision must be made as to whether the area will regrass naturally or if artificial reseeding will be necessary.

Some sites have so much grass that seeding is not necessary; others will require reseeding. Both annual and perennial grasses and legumes are used for this purpose.

The new grass cover must be carefully managed. If grazed, the cropping must be done when the plants will not be seriously weakened by excessive utilization. A dense grass cover of annual ryegrass has proven fairly effective in suppressing brush seedlings on new burns. It also provides fuel for a reburn, if desired, to destroy invading brush seedlings even though the stand cannot be maintained more than 3 to 4 years under the best of management.

RESEARCH CONSIDERATIONS

It is my belief that the best investment that could be made at this time is that of providing adequate funds for five forms of closely related wildland studies: (1) Soil-vegetation survey and related research; (2) basic plant research; (3) additional hydrologic watershed research; (4) fire-control studies; and (5) administrative fire-prevention and fire-control experiments.

1. In the southern California mountains there is particular need for information on both the vegetation and the underlying soil as a basis for the management of their resources, and for fire protection. Without such basic information recommendations of the most experienced land manager are subject to gross errors.

The soil-vegetation survey is a technical investigation planned to obtain accurate basic information on the kind and distribution of soils and natural vegetation, their relationships, and their characteristics and uses. It is specifically designed for mountainous wild lands; it provides an inventory of soil and vegetation resources of the land; and it provides fundamental information which is essential to improve the management of these lands for timber, forage, and water.

The hydrological and soil aspects of the dominant soil series are determined by soil and water specialists of the Forest Service and the University of California. The soil qualities are determined by field observation and greenhouse and laboratory studies to obtain information on the physical and nutritional properties of the various soil types. Permeability, water-holding capacity, and erodibility of a given soil type determine its hydrologic characteristics. The soil-vegetation inventory data are recorded on blue-line print maps with a scale of 2 inches to the mile to facilitate their use in the field. The delineations and symbols show, among other things, the kinds and density of vegetation covers such as conifers, hardwoods, chaparral, grass, and various mixtures of these; also the series and depth of soil. The written report discusses the composition, density, degree of timber reproduction, and the luxuriance of the vegetation. It also discusses, insofar as possible, the nutritional characteristics of the soil, its erodibility, percolation capacity, and the kind of vegetation which is best adapted.

It seems apparent that all phases of research in fire control, use of fire, and vegetational manipulations inherent in watershed studies should be preceded by a soil-vegetation survey. Information on the soils and vegetation should be helpful in the selection of representative research sites upon which to study pressing problems.

Soil-vegetation investigations are concerned with many problems in soil-plant and soil-water relationships that should be pursued further. These problems are enticing and challenging and their solution is of fundamental importance, but as yet no funds have been provided the soil-vegetation survey for such special investigations. Studies of this nature should include, among other things, more information on the behavior characteristics, productivity, and growth potential of the major soil series in the various wild-land regions of the State.

2. A phase of research largely overlooked in the study of fire control and fire behavior is that concerned with green, growing vegetation. Many disastrous fires have occurred under conditions rated as low in fire hazard, whereas others rated as of high fire risk have often been easily controlled and have offered no particular problem in fire control. The main difference between a disastrous fire and an easily controlled one seems to be in the ease and speed at which a disastrous fire can travel through "green foliage" and, under favorable conditions, become a crown fire. Accordingly, a knowledge of any condition of the green foliage which would favor fire spread should enter into a system of fire danger ratings.

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The more significant elements in classifying fire hazard in green foliage would appear to be: Foliage moisture content cycles of the dominant species as correlated with seasonal cycles; the nature, amount, and combustibility of the volatile oils produced by various plant species; the ease of combustion of foliar organs of different anatomical structures; chemical or physiological cycles of plants which may favor or indeed retard fire hazard at some seasons of the year; environmental conditions that could quickly change the resistance of green living vegetation to fire; and the regeneration capacity after a fire of those species that have strong fire resistant characteristics. Investigations of this nature should prove useful in testing or selecting species for particular situations or purposes where they would serve best.

3. Basic hydrologic watershed research should be greatly expanded over those now underway. This proposed expanded program should include:

(*a*) The setting up of 3 or more pairs of small watersheds, each 100 acres or more, in chaparral, situated on terrain suitable for grazing use, and in forested areas, preferably to be located in southern California. Each pair of watersheds should be fully equipped with climatological instruments, streamflow gages, and sediment catches. After thorough calibration of each pair of watersheds, which would entail several years because of climatic variability, the vegetation on the one watershed should be so manipulated as to show the effect of different types of cover on total water yield, quality of the water, and degree of erosion. Installations such as proposed are costly and time consuming to operate; but small inexpensive plots are no substitute for natural watershed installations and the results from them might be seriously misleading. These studies would supplement the basic work that has been underway for many years on the San Dimas Experimental Forest, where the watersheds are too steep for grazing.

(*b*) Since watershed and hydrologic studies involve both the physical and biological fields, adequate funds should be made available for the employment of physicists, chemists, plant physiologists, and highly trained foresters to carry out both field and laboratory studies on a scale commensurate with the importance of this much-needed and complicated task. Even with the undermanned scientific personnel now available to the California Forest and Range Experiment Station practical fire control in the State has been greatly advanced in the last 5 years. These studies have included better knowledge of the rate of spread of fires in different fuels and atmospheric conditions; the behavior of fire patterns in different vegetal types; the formulation of fog blankets and their application in fire control; chemical suppression and fire retardant substances; preliminary knowledge of the relative inflammability of different native and introduced brush species; and the feasibility of replacing the more combustible native forms by more succulent and fire-resistant plants. These worthy researches should be greatly expanded.

4. To date almost no so-called administrative experiments in fire control have been undertaken because of lack of funds. In southern California in particular, fire-control planning should be made on all high fire-risk units.

(*a*) There should be fire-control planning of each drainage area. This implies consideration of the proper balance and assembly of forces, means, and methods calculated to hold fire losses to a predetermined minimum in each resource management unit. With these thoughts in mind, the plan should aim, first, to provide an inventory of all control lines and the means of getting needed equipment and men to the area; second, to record all essential information on time and materials needed for construction of fire lines and the like; and, third, to formulate estimates of the manpower and equipment needed to cope with all fires that may occur within the area. The planning data are most effectively assembled on a multilithed three-color map to eliminate unwieldy data sheets.

(*b*) Use of chemical fire retardants in critical areas sprayed on the brush from the air or along roadsides in advance of the fire seems to hold much promise. However, the employment of chemicals demands that the toxicity or other harmful effects to irrigated crops be studied.

(*c*) Establishment of firebreaks around heavy use areas and on ridgetops to prevent, respectively, the spread of fires and for backfire purposes, should be further investigated. Also the formulation of "discontinuity" of fuel types on lower slopes adjacent to habitations and other "use areas" seems worthy of serious consideration.

The high flammability of the southern California chaparral is usually ascribed to the general characteristics of the vegetation, steepness of the slopes, and severity of the weather. Too frequently overlooked, perhaps, are the changes in the vegetation itself that affect its fuel qualities.

All evergreen California chaparral species grow new twigs and leaves in the spring and drop a portion of the older leaves and twigs in the summer and fall. According to Buck (1), the period of time for a chaparral canopy to reach full development after a fire is 8 to 12 years. During this time little deadwood or litter is produced and fire presents no particular problem.

When the site becomes fully occupied, annual production of current twigs and leaves is balanced by the death of old branches and stems. In years of average rainfall there is a seasonal cycle of low flammability caused by abundant foliar moisture in the spring and high flammability due to low-moisture content in the summer and fall. This annual cycle of balanced growth and death causes a gradual buildup of potentially combustible fuel. In years of drought the limited leaf growth and the large death rate of older growth reaches a high point of conflagration potential early in the season. In some cover types this accumulation may amount to 10 tons or more per acre by the time the stand is 30 to 40 years old. It is the desire to reduce this fuel that induces some people to suggest control burning. It is a logical deduction that a good way to dispose of excessive fuel is to burn it. As a matter of fact, the Los Angeles City and County fire departments practice this annually in their control-burning of vacant lots in the urban areas each spring.

Whether fire could be employed safely and economically in southern California on some of the steeper mountain slopes to form firebreak strips, or even on the flats and more gentle slopes, is a matter for experimentation. Two techniques of brush burning have been developed, both of which lean heavily on suitable atmospheric conditions at time of firing to obtain the objectives of brushland fuel reduction and control of the fire, namely, control burning and area-ignition burning.

Control burning, a technique now commonly employed for brush clearing in northern California, may be defined as "the planned application and confinement of fire to a preselected land area, most commonly natural brushlands." Prior to burning, fire lines are constructed and suitable locations for standby fire-control equipment, if deemed necessary, are selected. Fire is usually started along the lower sides of the area with the hope that it will burn off the brush cleanly, without escape to adjacent lands. The chief weaknesses of this method are the lack of positive fire control and the fact that the burning is often patchy, hence only partly effective in reducing fire hazard. Consequently, control-burning as presently applied seems to have little or no place in the highly flammable watersheds of the southern counties of the State.

Area-ignition burning, developed by the California Forest and Range Experiment Station (3), provides for the ignition of many individual prearranged fire spots to be ignited over the area simultaneously or in quick succession. So closely are these fires set that they influence and support each other. Shortly the flames join into one intense fire with an indraft so strong from the "fire storm" as essentially to prevent running of the fire. Area-ignition burning is especially suitable for clearing brushland and for range improvement and for chaparral fuel reduction; hence it appears distinctly worthy of trial in the chaparrel watersheds of southern California, even though this method also entails some risk of fire escape.

NEED FOR TRAINED MEN IN WATERSHED MANAGEMENT

Because southern California lies in a light rainfall region it has been troubled with water supply problems ever since the development of irrigated agriculture and the growth of cities. While surface-water supplies stored in reservoirs have been fully used almost every year, the amounts pumped from ground water have increased greatly. As a result, ground-water levels have dropped measurably, thus necessitating pumping at progressively lower depths and drawing on the "water capital."

As pointed out, just how the southern California wildlands can be made to yield maximum sustained flow most economically can only be determined through research. Watershed management—that is, management of the land from which our water comes—is predicated upon the condition of the land and its plant cover, and has a profound effect on water yield, on floods, and on soil erosion.

Unfortunately, our professional foresters and range technicians who manage the forests and rangelands have had little or no formal training in hydrology or watershed management, yet many of them are faced with intricate watershed management problems. They recognize the need of knowledge in hydrology and forest influences but for financial reasons few have returned to college to obtain the specialized training that is needed.

It is significant that most of the 17 accredited forest schools that teach one or more courses in watershed management have started them within the past decade (12). The University of California, through Prof. Joseph Kittredge, was the first—as early as 1932—to offer courses in watershed management. His text, Forest Influences, is a standard work on the subject of soil and water.

Recently steps were taken by a few farsighted persons to develop a plan for financing qualified scholars interested in watershed management training on a professional basis. To accomplish this the Colman watershed fellowship fund was set up in Berkeley, administered by the regents of the University of California. Dr. Colman, who devoted his entire life to watershed management, and one of Kittredge's students, later became head of the division of forest influences research of the California Forest and Range Experiment Station on the Berkeley campus of the university. Colman was one of the few men with a comprehensive training and understanding in watershed management. His text, Vegetation and Watershed Management (2) is a widely known and useful work on the subject.

Anybody interested in learning more about the Colman watershed fellowship fund should read the current article, Taming the Watershed (11), or should communicate with Dean Henry J. Vaux, of the School of Forestry, University of California at Berkeley.

SUMMARY OF RECOMMENDATIONS

Chaparral and sagebrush form a climax cover over limited areas in northern California but occupy a substantial part of the coastal region of southern California. Shrub-covered soils of the southern area that are of low suitability for grass production are more extensive than in the northland, the slopes are steeper, the vegetation is less dense, and the rainfall is more intense. Consequently, it is more difficult to control soil erosion and manage the watersheds for the greatest good of the people. Fire hazard is high in this brushy cover, and destructive wildfires occur every few years. The most important product of the mountain lands in southern California is water. But streamflow that is muddy becomes unusable and damaging. Burning is the principal cause of accelerated erosion and floods in the southern California brush areas.

Periodic burning of the brush is often advocated by well-meaning persons to reduce the brushland fuels and help prevent destructive wildfires.

Well-meaning persons have also proposed the replacement of brush with grass over large areas, through burning and reseeding, in order to reduce the volume of fuel to feed a fire and to decrease the moisture requirements over that of the chaparral. Studies to date indicate that the chaparral is generally the best adapted cover at present available for protecting the soil mantle. Although a grass cover may account for a somewhat larger carryover of soil moisture than brush below the 4-foot depth, such water accumulation would be confined to soils having a deep profile. In southern California a large proportion of the watershed soils are less than 18 inches in depth and therefore incapable of supporting more than a sparse cover of perennial grasses and/or forbs, but which do support a good protective cover of adapted shrubs.

A great deal of research is needed in southern California to learn how best to manage the watersheds for improved water yield, control of fires and floods, and improvement of such other uses as recreation and grazing.

Research on fire control, plant cover improvement, and water yield should be greatly expanded in southern California, and new studies should be undertaken. The following fields of research are suggested:

1. A soil-vegetation survey should be made of all the watershed areas, together with additional studies to improve survey methods and interpretations of information for land-use management. The information from such surveys is essential to fire control and improved watershed management.

2. Fire control and behavior studies should be expanded to learn more about moisture content cycles of the dominant species; relative ease of combustibility of foliage of distinctive anatomical structures; rate of ignition of volatile oils contained in the various plant species; nature of changes in the environment that quickly influence fire resistance of some species; and the regeneration capacity of species that have strong fire-resistant characteristics.

3. Watershed management and cover improvement studies, such as those under way on the San Dimas Experimental Forest, should be continued and expanded to learn more about the effects of land management and cover manipulation on water yield, soil erosion, and floods.

4. The funds now provided for basic research are but a fraction of 1 percent of the total expended in fighting disastrous fires. Yet only through research can these expenditures be significantly lowered. Adequate funds should be provided without delay.

5. Financing for graduate study is essential to the training of qualified scholars in watershed management. Partly to meet this need a watershed fellowship fund has been started to aid in the training of qualified persons for this important service.

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The CHAIRMAN. Thank you very much, Mr. Sampson.

The next witness is Mr. Harry W. Brelsford.

You are an attorney at law, 916 Anacapa Street, Santa Barbara, Calif. You will speak for the Federated Sportsmen of Santa Barbara. Is that correct?

STATEMENT OF HARRY W. BRELSFORD, ATTORNEY, SANTA BARBARA, CALIF., ACCOMPANIED BY S. A. NASH-BOULDEN AND ADRIAN G. WOOD

Mr. BRELSFORD. That is correct, Mr. Chairman.

The CHAIRMAN. We will be glad to hear you. Do you have a prepared statement?

Mr. BRELSFORD. Yes; but I do not intend to read it to this committee. The gist of the statement is contained on the first two pages.

We bore in mind the admonition of several months ago that you did not want to listen to laymen but to experts, and we have two experts who have advised in the preparation of this. Both of their names appear on page 7. One is Nash-Boulden who is former supervisor of our Los Padres National Forest. He is now retired, and he, therefore, can speak freely his own views on fire management obtained over years of practical experience.

Our second expert is one more by age than experience. Mr. Wood, whom this committee has invited to come before it, is a young man

who has traveled extensively through Los Padres National Forest and observed firsthand the continued reburning, pretty nearly on an annual basis, that the cattlemen conducted.

Accordingly, I will not take any time to repeat the matter in here. I would prefer your questions be directed to Mr. Nash-Boulden who is here today.

I want to comment on our three recommendations:

First, that Federal legislation be enacted setting up controlled burning as a tool of the foresters for brushland fire management.

I realize the Forest Service could do that already, but I think they need a little bit of legislative assistance before they would actually do it.

Secondly, I think the most important recommendations from a practical standpoint is that the firefighters be given immunity from suits when they are acting with reasonable diligence. In our country when we have a fire we cannot get them to fire off a backfire most of the time because they are afraid they will burn up somebody's property and get sued. They would much rather see the property burn up than take the risk of burning with a backfire where they might get personally sued.

If it proves to be desirable to have a controlled burning, the law is such that this liability is imposed more severely than in the case of accidental fires, and I do not believe you would get any effective control burning by any personnel unless you had this immunity from the suit.

In this recent case that originated in the State of Washington, the United States Supreme Court case, the Federal Government was held liable for negligence of the Forest Service in fighting a fire.

The third recommendation is also important from a practical standpoint, namely, that brush fighters should be retained.

The average forestry graduate sees his future connected with tall timber, lumbering, and he does not want to be relegated to brushland such as we have up in Santa Barbara, and he is unhappy with that situation. They try to rotate them rapidly, and you do not get skilled firefighters.

Those briefly are the reasons for the recommendations, Mr. Chairman, and the other things are in the statement, and that concludes my statement.

Thank you.

(The statement submitted by Mr. Brelsford follows:)

FEDERATED SPORTSMEN OF SANTA BARBARA, CALIF.

To: Hon. Clair Engle, Chairman, Committee on Interior and Insular Affairs
From: Federated Sportsmen of Santa Barbara, Inc.
Subject: Hearing on United States Forest Service

RECOMMENDATIONS

The Federated Sportsmen of Santa Barbara, Inc., having 850 dues-paying members, respectfully recommends to this honorable committee:

1. That Federal legislation be enacted setting up controlled burning as a tool of the Forest Service for brushland fire management.

2. That Federal legislation be enacted removing liability from the United States, its officers and employees, for damage in fighting fire and conducting controlled burns, except for gross negligence and willful acts.

3. That the Forest Service be induced to train and maintain personnel skilled in brushland fire fighting, rather than use brush areas as training grounds for big-timber fire fighters.

FACTS

In support of the foregoing, the Federated Sportsmen have established the following facts by persons who are experts. These facts are applicable to those portions of Los Padres National Forest located in Ventura and Santa Barbara Counties.

1. The fire hazard existing is caused by the accumulation of large amounts of flammable fuel per acre.
2. The Forest Service has consistently refused to reduce the amount of fuel per acre.
3. The Forest Service is unable to reasonably control fires that start in Los Padres Forest under high fire-hazard conditions, regardless of access to the fire.
4. The fuel content of Los Padres Forest can be economically reduced by controlled burns without substantial damage to watershed values.
5. Repeated burnings by "cold" fires will control fuel content of the forest and will permit natural reseeding of plants and grasses.
6. The Forest Service will be freer to conduct controlled burns if legislation is passed to remove the liability for negligence in fire fighting which was imposed January 28, 1957, by the United States Supreme Court in the case of *Rayonier Inc.* v. *United States* (77 S. Ct. 374, 1 L. Ed. 2d 354).
7. Fighting fire in brushland country requires specialized experience, knowledge and skills not possessed by persons trained in big-timber fire fighting.

THE PRESENT FIRE HAZARD IS SEVERE

Slightly over 1 million acres (1,187,958) of Los Padres National Forest are located in Santa Barbara and Ventura Counties (see map attached). Sixty percent, or 720,000 acres are regularly closed to public entry from July 1 to November of each year. This is the biggest block of regularly closed national forest in the United States and hence must be the most hazardous, according to Forest Service criteria.

In addition, the biggest acreage fire in California occurred in this forest in 1932. This was the Matilija fire that burned in Ventura and Santa Barbara counties and covered 219,000 acres, or 342 square miles. The Big Dalton fire in 1953 in Santa Barbara County was the fastest burning fire in California, burning 10 miles in 5 hours. This fire covered 73,500 acres. These facts amply demonstrate the severe nature of the fire hazard that exists.

THE PRESENT FIRE HAZARD IS CAUSED BY THE ACCUMULATION OF LARGE AMOUNTS OF FLAMMABLE FUEL PER ACRE

Shortly after taking over the control of the forest lands about the year 1900, the Forest Service adopted a policy of preventing burning of brush. This was in contrast to the policy carried on for centuries by the Indians, then the Spaniards and then by the American cattlemen. Since that time many generations of brush have matured and died and except where recent fires have cleaned it out, the already combustible brush is choked by generations of dead brush, much of it still standing.

Protection of timber is not the basis for this nonburning policy, inasmuch as the timber (located on the higher mountains) is so small in acreage and so inaccessible that it is unmerchantable.

THE FOREST SERVICE IS UNABLE TO CONTROL BRUSH FIRES UNDER HIGH FIRE HAZARD CONDITIONS

The Refugio fire of 1955 demonstrates the inability of the Forest Service to control brush fires. This fire started on a mountain range west of Santa Barbara where there was excellent access to all parts of the range. A major highway, U. S. 101, bordered this range on one side and a parallel State highway on the other. Public roads and numerous private ranch roads gave lateral access. In addition, a serviceable road ran the length of the ridge. Nevertheless the fire burned unchecked for 15 miles in each direction until it burned out against highway rights-of-way.

The most gigantic effort was made to pour in men and machines to fight the fire, whole fleets of ready-mix trucks, for example, being used to haul water, and fire fighters being flown in from distant States. Despite this effort and the expenditure of three-quarters of a million dollars ($750,000), the fire could not be checked, although many fire lines were constructed in its path. The net fire

fighting result was the saving of numerous ranch houses which were accessible to tanker fire trucks.

The more recent Malibu fire (fought by the Los Angeles County Fire Department) also demonstrates the inability of fire fighters to stop brush fires where the brush has a high fuel content and the conditions are hazardous, even though there is access to the fire.

CONTROLLED BURNING IS INEXPENSIVE COMPARED TO FIGHTING UNPLANNED BRUSH FIRES

The Refugio fire burned 85,000 acres with an expenditure of $750,000, about $9 per acre. In contrast to this, the State of California has burned brush with controlled burns in northern California for a cost as low as 45 cents per acre for burns of 400 acres or more, and for a cost as high as $2.95 per acre for burns as small as 40 acres.

Furthermore, the cost of fighting unplanned brush fires is high compared to normal Forest Service operations. The present total budget allotment for the entire Los Padres Forest, covering 5 counties is $1,115,000 compared to $750,000 additional for just one fire. Normal budget allotments plus costs of fighting fires would permit controlled burning of much of Los Padres National Forest.

REPEATED BURINGS BY "COLD" FIRES WILL CONTROL THE FUEL CONTENT OF THE BRUSH AND PERMIT NATURAL RESEEDING

The present unplanned brush fires destroy all seeds of trees and plants because of the terrific heat generated by the high fuel content of Forest Service brush. Reseeding with grasses and other desirable plants is necessary. However, subsequent grass and brush burns, especially under high humidity conditions, produces a "cold" burn that does not destroy the seeds. In this manner the brush growth is retarded without retarding grass regrowth.

This cold burn practice was successfully used in past centuries and is being used today by cattlemen to return brushland to productive use.

CONTROLLED BURNS DO NOT SUBSTANTIALLY DAMAGE WATERSHEDS

The Forest Service admits that grass does as good a job as brush for holding the soil in place and preventing erosion. Reseeding burns in Los Padres National Forest with annual plants has been successful and inexpensive. In many normal winters, even a bare slope with no cover will not seriously erode. For example, the rains of the last three winters have been light and evenly spaced so that the runoff has been nil. Under cloudburst conditions the hills will badly erode even when covered with dense brush.

Grass has roots about 2 feet deep at most and after May dries up and uses no water. Brush, by contrast, has roots as deep as 20 feet, and consumes water in depth all year around. Burning and other brush removal has revived dried up springs and streams. Brush, therefore, is doubtful protection for a watershed, consuming water instead of conserving it.

THE SUPREME COURT HAS IMPOSED NEGLIGENCE LIABILITY UPON FOREST SERVICE IN FIGHTING FOREST FIRES

Prior to 1957 Forest Service employees generally assumed that they and the United States were free of liability for their acts in fighting fire. In the January 1957 case of *Rayonier Inc.* v. *United States* (77 S. Ct. 374) the United States Supreme Court held that the United States Government was liable under the Federal Tort Claims Act for negligence in fighting fire.

This decision will make more timid than ever the fire-fighting officials of the Forest Service. During the Refugio fire (1955) there were repeated instances of firelines constructed with much effort and toil so that backfires could be started. While the reasons for this refusal to order firing are difficult to learn, it is generally believed by the lay observers that it was fear of personal liability for property damage that led to this inaction. Apparently it was preferred that the main fire destroy this property rather than take a remote chance of destroying it with a backfire.

This same timidness would, of course, be the death blow to any program of controlled burning. Legislation therefore would seem to be in order to remove this fear from the fire-fighting officials.

FIGHTING BRUSH FIRES IS A SPECIALTY

The Forest Service has a fixed policy of fairly rapid rotation of fire-fighting officials. Presumably this is to give them experience. Most of them are career men who see their personal future identified with the valuable timber forests. Most have no desire to make brush fire fighting their objective. The result is that few officials are properly trained to fight brush fires. As a consequence a generally poor job is done on fighting brush fires.

The correction of this condition would appear to be an administrative problem, but it is hoped that this legislative committee can induce a change in Forest Service management in this respect.

Respectfully submitted.

FEDERATED SPORTSMEN OF SANTA BARBARA, INC.,
By HARRY W. BRELSFORD, *Legislative Counsel.*

The CHAIRMAN. Thank you very much, Mr. Brelsford.

Mr. Greer, from Santa Barbara, are you here?

Mr. GREER. Yes, sir.

The CHAIRMAN. Is your statement in the same category as those just heard?

Mr. GREER. It concerns the Los Padres area.

The CHAIRMAN. Would you like to make your statement now?

Mr. GREER. I would.

The CHAIRMAN. Fine. We will be glad to hear you.

Mr. Greer, do you represent yourself or yourself plus someone else?

STATEMENT OF FRANCIS C. GREER, SANTA BARBARA, CALIF., REPRESENTING THE BOARD OF SUPERVISORS OF SAN LUIS OBISPO COUNTY

Mr. GREER. I represent myself plus someone else, Mr. Chairman, the county of San Luis Obispo.

The CHAIRMAN. State your name and who you represent for the record.

Mr. GREER. Francis C. Greer; I represent myself, and am a former member of the Watershed Fire Council of Southern California. Today I am also speaking officially for the Board of Supervisors of San Luis Obispo County, with your permission.

The CHAIRMAN. Thank you very much. We will be glad to hear your statement.

Mr. GREER. I am Francis C. Greer of Santa Barbara. The counties of Santa Barbara, Ventura, and San Luis Obispo have within their boundaries, as you, Mr. Chairman, have described it, "the largest pile of inflammable brush in southern California." It is known as the Los Padres National Forest, comprising 1½ million acres. These brushlands comprise our watersheds. They are very steep and highly erodible. These three counties are dependent on these watersheds. There is no imported water available to them, and none will be in the near future.

Reservoir sites are not easy to find, and if they are destroyed by silt or debris, they are practically gone forever. The city of Santa Barbara lost one-half of the capacity of its Gibraltar Reservoir many years before the bonds were paid off, and another bond issue was necessary to raise the dam. The city water commission engineer informed me last year that is the end of raising that dam. There is no more suitable shoulder site there in the mountain to go any higher.

I would like to have the members of the committee look at that picture, if they will. That was a debris dam built to save the Gibraltar Dam; 2 years and 3 months after that structure was erected it was filled with silt and debris and had no further useful purpose.

The Watershed Fire Council of Southern California presented a plan to correct this situation. It was approved by the head of the United States Forest Service, Dr. McArdle. The Congress appropriated funds to implement this plan, and has increased the amount gradually. It is now $900,000 for the 4 forests in southern California.

The plan called for $2,325,000 annually for 10 years, except for Los Padres Forest. That was to be for 20 years. I hope your committee, after study, will recommend to Congressman Kirwin's Committee on Appropriations that the full amount necessary be appropriated next year, and that the work contemplated on Los Padres Forest be expedited. We cannot wait 20 years for full protection.

Access roads, firebreaks, trails, and water tanks called for in the program will break up the vast areas of brush in this 1½ million acres. Men and equipment will be able to attack fires with safety, and confine them to smaller areas. Our watersheds and reservoirs then will be reasonably safe. It will allow new areas to be opened for recreation and, most of all, protect our already short supply of water.

The city of Santa Barbara and the community of Montecito were on a water-ration basis in the late 1940's. We are threatened again if rainfall is not sufficient this winter. More research is needed on the management of watershed lands, ground cover, fire protection, and erosion problems. With the proper funds available, I feel sure the answers will be found. Until that time we must protect what we have. We cannot afford the loss of 1 gallon of water or 1 cubic foot of soil.

Mr. Chairman, I would like, with your permission, to read a telegram I received yesterday from San Luis Obispo County.

San Luis Obispo Board of Supervisors in session here today has authorized you to speak on behalf of San Luis Obispo County regarding the program of the United States Forest Service for southern California before the Engle committee tomorrow. San Luis Obispo County wholeheartedly endorses the program of the Watershed Fire Council of Southern California and urges continued support of it through adequate appropriations as essential to the continued growth of this area. A substantial part of this district has been preplanned, including firebreaks, helioports, and heliospots and so forth under the program. Additional moneys from local sources, including flood control and fish and game moneys, have also been used on cooperative projects to further the program. The level of protection is still below that desired, in spite of the efforts made to date by all concerned. Continued support of the program until its ultimate development is accomplished is most important. I regret that the press of other business prevents my appearing personally before the committee on behalf of the board of supervisors.

That is signed by B. D. Conrad, Jr., administrative officer, board of supervisors.

The CHAIRMAN. Thank you very much.

In connection with that, the record will also show the Cuyama Valley Sportsman's Club, according to their telegram, is in favor of control burning. The telegram is signed by J. D. Siournoy.

Without objection it will be made a part of the record following Mr. Greer's statement.

Hearing no objection, it is so ordered.

Mr. GREER. Mr. Chairman, in further information on this, the city of Santa Barbara last week, at the request of the water commission, requested the city council to close the Gibraltar area to fishing, the Gibraltar Reservoir area; and their water superintendent has requested the Federal closure of Gibraltar Reservoir Watershed to be effective in order to preserve the cover on the watershed.

We have the same situation here. The Juncal Dam serves the Montecito area. It was above Gibraltar. Cuyama was built below it. The Cuyama has never had over 40,000 acre-feet in it. It has a capacity of a little over 200,000 acre-feet. It is down now to around 20,000 acre-feet.

We are not making the statement that our water situation is serious casualty. It is serious.

When you take an area of over 50,000 people, that is, in the city alone, and have to put them on a water ration, it is quite a problem.

Montecito—I could not give you the population. I have no idea. It is three to four thousand people anyway, and it may be five to six thousand. They were on a water ration over 2 years, and not a single new water connection was built in that area. They are so concerned, and have been.

They have their own fire department. They enjoin the boundary of Los Padres. They tax themselves for fire protection, alone, over a dollar per hundred assessed valuation. They have additional taxes to build firebreaks. They passed the hat around in the community and collected in the last 2 years over $15,000 to build additional firebreaks to protect themselves from Los Padres, and Los Padres from anything that might occur in their area.

We have a bad situation that has been mentioned before. We have records we are not proud of. We have the biggest fires of most any place in California. They burn faster because they come at those periods of time when you have 50-, 60-, 70-mile winds and, as was mentioned here this morning, you cannot run away fast enough when the fire takes place.

We feel the majority of the fires, if this program is allowed to go ahead, will be able to be held to smaller acreage, the loss will be less, and in the end it will be money in the pocket of the Federal Government. They will not have to get out and write these checks to pay suppression costs on an individual fire from a half a million to a million or more.

I thank you, Mr. Chairman.

The CHAIRMAN. Does that conclude your statement?

Mr. GREER. There is one other thing that might not be exactly pertinent, but I would like to offer it to you—the instance of the south coast areas in Santa Barbara County going to the Federal Government and getting the funds to construct the Cuyama Dam, put a tunnel through the mountains and a distribution system. It amounted to some $46 million, which will be repaid to the Federal Government by those areas.

It is my thought that when the Federal Government goes into any such program, whether it be on federally owned land or private lands, and puts up that amount of money, or any amount of money, that the proper protection for the watershed involved should be a part of the plan, just as all the plans concerned with the dam there, and the tunnel, and the distribution system. If the Government lends a man

money to buy a house, the first requirement is that he insure the house from fire, and I think it would be just good business, and it would also put the people in the area involved aware of it, because I think some of that capital cost should be charged to the project and let the people pay for it, which I am sure they would be willing to do.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Mr. HALEY. Mr. Chairman, before the gentleman gets away, he offered a map here. May I make a couple of inquiries on this?

The CHAIRMAN. Mr. Haley.

Mr. HALEY. This picture of a dam here. On the back of it, it says it was built in 1936 and filled in 1938.

Mr. GREER. That is correct.

Mr. HALEY. This dam was built apparently to protect some reservoir somewhere else.

Mr. GREER. Downstream from the city's Gibraltar Reservoir.

Mr. HALEY. Under whose auspices were the reservoir and the dam constructed?

Mr. GREER. The reservoir was constructed by the city of Santa Barbara through a bond issue voted by the voters. That dam was built by the Federal—you were there, Gus—by the CCC in the thirties.

The CHAIRMAN. We have not identified Gus.

Mr. GREER. Mr. Nash-Boulden. Excuse me.

Mr. HALEY. Can you tell me how long this dam was proposed in the original instance to protect the reservoir, because I notice you say the reservoir is not filled?

Mr. GREER. The reservoir is half filled. I do not know as anybody knew how long that would protect the reservoir. It filled up in 2 years and 3 months, slightly over 12,000 acre-feet, and it did hold that much from going into the reservoir. So it served a purpose.

But our point is that up there we have to have something on the hillside to hold that dirt in place and not get it down in the reservoir, and that is an expensive way to try to do it.

Mr. HALEY. It makes good land, though; does it not?

Mr. GREER. Well, if you could get to it. What would it cost to build a road there, Mr. Nash-Boulden?

The CHAIRMAN. We will get to the questions directly.

Does that conclude your statement, Mr. Greer?

Mr. GREER. Yes, sir.

(The telegram from the Cuyama Valley Sportsman's Club follows:)

BAKERSFIELD, CALIF., *Oct. 8, 1957.*

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
United States Post Office, Los Angeles:

Cuyama Valley Sportsman's Club is in favor of control burning by Government agency, and would like to offer their service to any organization that is in favor of such a program so that thousands of acres of California unusable brushland may be returned to productive recreational areas, thus making California a better place to live and do business.

J. D. SLOURNOY.

The CHAIRMAN. We have a pretty good group here, and they are all talking about pretty much the same thing. May we have Professor Biswell, Professor Sampson, Mr. Brelsford, and Mr. Greer all right along here?

Mr. BRELSFORD. I defer to Mr. Nash-Boulden as the expert for our group.

The CHAIRMAN. We will be glad to have Mr. Nash-Boulden up here. I believe your statement referred to him.

Mr. BISWELL. Yes, it did, Mr. Chairman. He is former supervisor of our Los Padres National Forest, which covers five counties along the coast.

The CHAIRMAN. We started out with Professor Biswell.

Professor, in your opening statement I fail to observe your address or anything regarding your qualifications. Would you please give your address for the record so we will have it?

Mr. BISWELL. The University of California at Berkeley; professor of forestry, and I teach range management, and do research in fire and brush.

The CHAIRMAN. How many years have you been working in the field of forestry and land management?

Mr. BISWELL. Since 1934.

The CHAIRMAN. And you are not only a professor in the school of forestry but you are active in the field of land management?

Mr. BISWELL. Research.

The CHAIRMAN. Research of various kinds. What does that embody—the soil covers and all that sort of thing?

Mr. BISWELL. At the present time I am working on the problem of multiple-use management, which covers most every phase of wild-land management, soil, vegetation cover, so forth.

I started to tell a little something about my experience. That is what you asked for.

The CHAIRMAN. We are very interested in that, because what we want to do, Professor, is to get what we regard as expert testimony. There may be some people who would argue that a professor of forestry is not an expert, but we think the observations of people who have made a long and consistent study of forestry practices and land management might have something to contribute to our thinking on this subject. That is why we asked for you and for Professor Sampson.

Mr. BISWELL. For 6½ years I worked in grassland problems in the foothills of Madera County, that is grass type of vegetation, and then I spent 6½ years in southeastern United States where I did this prescribed burning in longleaf-slash pine forest. Then I came back to the University of California in 1947, and during the last 10 years I have been carrying on studies of control burning and other means of brush removal, reseeding, and so forth, on brushland, and for the last 6 years have been making studies of prescribed burning in second-growth ponderosa pine.

So in the university I teach approximately half the time and do research the other half.

The CHAIRMAN. In other words, you try to tell the young folks what you have learned?

Mr. BISWELL. I have to keep up to date.

The CHAIRMAN. Reading your statement and looking over some of the exhibits that you have handed in here, would it be a correct summary to say that you believe in some instances controlled burning is helpful?

Mr. BISWELL. When I speak of controlled burning I am making reference to brushland and not to the forests. When I speak of prescribed burning I am talking of burning in the forests.

The CHAIRMAN. What kind of burning do you call that?

Mr. BISWELL. Prescribed. We carefully plan just how we are going to do it. In other words, you write a prescription and then proceed, and because of the confusion and so forth I have given that the name of prescribed burning. That is in the forest. Then when I get out into the brush I call that control burning.

When you ask that question and say, "control burning," then I am talking about brush.

The CHAIRMAN. That is a confusion of terms, so I want to be careful to say precisely what I mean.

In referring to controlled burning, referring to brush areas such as, for instance, we have in the Los Padres and some other areas, some of these areas down South, do you think burning can be handled in this kind of an area?

Mr. BISWELL. I have not experimented here in southern California. Most of my experience has been in Chamise brushland in Lake County and in woodland grass brush areas in the foothills of Madera County. But I certainly think that controlled burning, as I mentioned in my report, should be tested as one means of reducing fire hazards, reducing the fuel, and I propose there a study and a test of rotation burning based on about a 20-year rotation.

The CHAIRMAN. But you make it very clear that you have not had any experience in that type of burning in this particular type of watershed, and that question is significant in view of the testimony this morning.

Now prescribed burning, the type indicated in these magazine articles that were attached to your statement, and which are very revealing: I would assume in appropriate cases you favor prescribed burning for the purpose of reducing the fuel content of the forest. Is that right?

Mr. BISWELL. I doubt if there are very many pondersoa pine areas in California where the fire hazard could not be reduced, and I think one of the principal fields there in reducing the fire hazard could be prescribed burning under the techniques we have explained in these publications. That prescribed burning is done during the fall, winter, and spring when the soil is wet. It takes maybe 4 or 5 or 6 inches of rain to seep down and get the soil wet. Then after the soil is wet, in about 2 or 3 days, the pine needles will dry out on the surface when the lower pine needles are still wet, and you can ease the fire through.

The technique is to start at the top of the ridge and let the fire burn down the slope subsequently. And the first fire should be a very live fire so it will burn out stumps and logs and so forth. Then in 1 more year another fire can be put through under just slightly drier conditions to burn a little bit more of this fuel. We never attempt to burn all of this fuel at one time. If we did it would be just too much heat.

So the technique is to burn under conditions when the fire will burn subsequently, and the reason we can do that is that these pine needles will burn when practically nothing else will burn. They make a wonderful field for carrying fire.

The pine needles on the ground are the most important consideration in this prescribed burning in California. In my burning down there for 6½ years, in the southeast, in longleaf-slash pine, we had 2 types of fuel there to carry fire. One was the pine needles themselves, and the other was the grass. And the burning there was also in wintertime. The grass was of the wire-grass type, and it will burn during the wintertime. So we eased the fire through the grass and pine needles. If there were no trees there, still the grass would burn and carry the fire.

Here in California we can ease the fire under the ponderosa pine, but if you have an area of brush out here we can burn under the pine when the brush will not burn.

The CHAIRMAN. Is it your view, as was suggested here this morning by my friend from Pennsylvania, Congressman Saylor, that burning destroys values in the land of some type?

Mr. BISWELL. When he says "values" I do not know what he means.

The CHAIRMAN. I was not sure either, but I thought he was referring not to making it susceptible to erosion or physical change, but the destruction of the capability of that land to produce in the nature of fertility or vitality of some sort.

Mr. BISWELL. Well, the most complete study I know of that came to my attention, 2 weeks ago—and this was a study by a soils man back in the East. He made a study in the forest, and he had three situations:

One was where he said the growth of the forest under conditions of accumulation of materials and so forth. The other situation, he burned it every year for 20 years.

There were four situations.

He raked all the pine needles off one area and put them over on another area, so this area had twice as many pine needles as the area untreated. And the area raked off, of course, did not have any. And the other was burned annually, and annual burning increased the growth of trees by 8 percent.

Where he moved over onto the other plot, it was 40, showing the pine needles did have a definite fertilizing effect.

Mr. RHODES. Will the chairman yield?

The CHAIRMAN. Yes; I yield.

Mr. RHODES. I think what the gentleman from Pennsylvania had in mind was some sort of decrease in the porosity of the soil so that water ran off faster after than it did before. I am sure that is what he had in mind.

Mr. BISWELL. If you look through our publications here in this prescribed burning—and this was brought up several times this morning—one of the general principles in land management you can apply anyplace—and it is a general principle—is that you should keep the soil covered, and it could be covered forest soil or grass or a combination.

In ponderosa pine the burning is done under the trees themselves so that we have a forest cover.

Here [indicating] is the forest cover. This is a cover of trees, and this cover of trees drops 2,000 pounds of pine needles a year.

In this burning we never plan to destroy the duff. The duff on the ground is the most important part of the forest. It is more important

than the trees because, if you lose the duff, Mr. Chairman, you are going to get runoff and lots of erosion, and it is a losing game to get rid of this duff.

The CHAIRMAN. How do you burn it without burning off the duff?

Mr. BISWELL. This duff gets fairly deep, and we wait until after a rain and the soil and the duff is wet, and the soil is wet all the way down, and then it dries off in 2 or 3 days, and then you can burn off the top and not destroy this lower duff.

So in this burning we made measurements. We measured the duff and pine needles before burning, and after burning we find a single burn will reduce about half of it, get rid of about half of it.

So this duff is one of the most important parts of the forest, and management should always be directed toward maintaining this duff.

If we have the duff, we have high infiltration capacity, and the water goes into the soil, out down through the soil and seeps out down below. So we have a half-regulated streamflow.

The trouble with intense wild fires is not only are the trees killed, the duff is destroyed, the pine needles are destroyed. The soil seals over and we get intense runoff and floods, and we get soil erosion, and when that happens it is a tremendous job to get this back into forest.

The CHAIRMAN. In other words, when the forest grows up into enough brush so that when it catches on fire it burns not only the duff on the ground but the trees above the ground——

Mr. BISWELL. The trees above——

The CHAIRMAN (continuing). Then you have conditions for the kind of soil erosion that we do not like to get.

Mr. UDALL. Will the gentlemen yield to me? I am very much interested in this subject.

The CHAIRMAN. Yes, sir; go ahead.

Mr. UDALL. Dr. Biswell, is the theory expressed in your presentation here today generally held by other counterparts of yours in other forestry schools of the West?

Mr. BISWELL. Well, this prescribed burning has been studied very little, if any, in California except here in the past 6 years.

Mr. UDALL. What I have been attempting to describe this morning, if you heard me, this ponderosa pine forest in Arizona on the Indian reservation, there they were carrying out these experiments on a rather large scale that you have called prescribed burning.

Mr. BISWELL. Yes.

Mr. UDALL. They intimated to me it was sort of an unorthodox, radical idea, or at least it was so regarded by the Forest Service people, that they had always followed a different theory on it.

The real question I want to ask you is: Are the National Forest Service people showing interest in this idea? And are they carrying out experiments of their own to see whether it is sound and will work on a large scale?

Mr. BISWELL. If they are carrying out studies of this sort in California, I do not know about them. But the Forest Service does and is carrying on considerable studies of this sort in other parts. For example, down in Southeastern United States, in the long leaf slash pine type they burn largely each year, and it is well known it is a technique that the Forest Service uses in protecting forest management.

Mr. UDALL. It has not really been adopted and it is not being pursued aggressively at the present time in our ponderosa pine forests and similar forests in the West; it is still in the experimental stage?

Mr. BISWELL. You say in the West. You mentioned the Indian Service?

Mr. UDALL. Yes.

Mr. BISWELL. They are probably doing some up north in Washington and Montana.

Mr. UDALL. Thank you. That is what I was interested in.

The CHAIRMAN. Professor Sampson, I wanted to get a little more of your qualifications in the record because your statement regarding them is somewhat niggardly.

You are professor of forestry emeritus of the School of Forestry of the University of California?

Mr. SAMPSON. That is right.

The CHAIRMAN. Did you teach forestry there for a number of years?

Mr. SAMPSON. Yes. I was invited to the university in 1923, and I was given two fields of teaching. One was forest ecology, and the other was range management.

The CHAIRMAN. What is forest ecology?

Mr. SAMPSON. Forest ecology is the study of the forest in its natural state—why does this particular tree occupy this area; why does it not grow over in this other area; and what are the life history requirements for growth and reproduction?

That is just a simple example.

We study the factors that are favorable to growth, unfavorable to growth, and so on.

The CHAIRMAN. You had some experience also in the field of grazing, did you not, on the public land areas?

Mr. SAMPSON. Yes, I have. I was with the United States Forest Service, in research, from about the day I graduated from college until 1923 when I was invited to the University of California. During those years I was in range research, was moved to Utah in 1912, was Director of the Forest and Range Experiment Station there until in 1923 when I came to California.

The CHAIRMAN. You asked some questions in the early part of your statement. For instance, you raised the question in your statement regarding what the Indians did. What I would like to ask you is whether or not you think the Indians knew their business.

Mr. SAMPSON. I think they knew their business. I think they grew tobacco pretty well. And I believe they protected their own habitation fairly well.

The CHAIRMAN. I gather from the statement here that the Indians did, either one way or another, either through negligence or design from time to time, burn off large areas around them.

Mr. SAMPSON. Fires undoubtedly got away from time to time. Whether they meant to burn large areas or not I do not know.

The CHAIRMAN. Then the next question:

If the Indians' methods are clearly established, the question is whether or not the Indian methods are appropriate to our current situation and will meet the needs that we have at the present time.

Do you think we ought to burn now without any discrimination about it, such as the Indians did?

Mr. SAMPSON. I should think we should be extremely discriminatory, for this reason: There are few areas, say, here in southern California where one can establish grass or you can replace the brush by grass, because of the thinness of the soil. You have got to have a soil from 15 to 18 inches deep if you are going to establish a grass cover, and much of our brush fields are less than a foot deep. Some of them are only a few inches deep. They are not suitable for conversion.

Therefore, through the soil-vegetation survey, if we can spot the areas that are suitable for grass growth, we have a big advantage there.

The CHAIRMAN. You have made some examination of what occurred before the white man got here?

Mr. SAMPSON. Yes.

The CHAIRMAN. I have been told that all of southern California along this coastal area was a green rolling virgin mountainside with nothing but an occasional tree and piece of brush now and then, under Indian management; and since the Forest Service took over it had grown up into a veritable brush pile, flammable in character, and endangering the lives and property of everybody. Is that a historical statement or not?

Mr. SAMPSON. I doubt that there is much to that. The reason I say that is that the early explorers speak of the dense brush they encountered. And even in the forest they speak of heavy brushland. So to what extent they got through the forested areas no one knows. But we can trail the early explorers, and they got over areas that we know pretty well now, and areas which are brushy now were brushy then.

The CHAIRMAN. Maybe they were so glad to get home, after they got home they forgot the hardships of where they had been. I have been on some hunting trips that made me feel that way.

Now Mr. Greer from Santa Barbara. You are the one who quotes me as saying you have the largest pile of flammable brush in southern California.

Mr. GREER. Yes.

The CHAIRMAN. That is a questionable distinction. I do not know whether it is any honor. Do you subscribe to that statement?

Mr. GREER. Yes, sir, in the newspaper sense that you described southern California lands as that. And I think you were correct, and we have the largest one. Whether there is any real distinction to it, it is a nuisance and a menace in many ways. But, still, that is where we get the water. I do not know whether everybody realizes that is a large area, that Los Padres Forest.

The CHAIRMAN. For the benefit of some of my colleagues who may not be familiar with the geography, will you say in general where it is from here?

Mr. GREER. Los Padres Forest starts about 30 miles from here out at the corner of Los Angeles County, up through Ventura, Santa Barbara, and San Luis Obispo County, takes in a small sliver of Kern County and on into Monterey County. If you scaled it off on the map, you gentlemen might look at it better this way.

If this end out here in Los Angeles County was in Washington and you had a fire in the other end, you would have to send your fire

engines up to the outskirts of the city of Buffalo, N. Y. If you went northwest, you would land out in Akron. That is the area the whole forest takes in.

The CHAIRMAN. That is a good illustration, and I am glad you used it.

Mr. GREER. I am only concerned particularly and should talk about our three counties. As I say, we have no water, only what falls in those watersheds. I do not think many people, Mr. Chairman, living here realize that in this community they use water out of Rush Creek up in your district. That all comes down here. By the same token, water is brought in here from Wyoming, Colorado, Utah, Arizona, and we do not want to be selfish altogether. We would like our watersheds protected.

By the same token, we think the Government ought to do a lot more on some of these other areas.

Water is about the most important thing we have today. It seems every month or so we read of a new use for water for some development that takes an increased amount of water. It has to be protected. Every country that did not protect their water, regardless of where it was, has gone practically out of existence—the Arabian area, the old Biblical area. Egypt survived, but they had nothing to do with it. The Nile River flowed through there and did its own job. I suppose if they could have done something to the Nile River, they would have spoiled it.

The CHAIRMAN. In your statement you have not recommended controlled burning as a tool for this brushland management. However, you have suggested access, firebreaks, and trails, and water tanks, and that sort of thing.

Mr. GREER. Yes.

The CHAIRMAN. You think you are going to have to keep those brush areas up there to conserve the watershed; is that right?

Mr. GREER. Conserve our watershed, conserve the water, and keep the soil in place in the watershed until some better way, through research and scientific knowledge, shows us we can dispose of the brush and replace it with something else that will do the job as well.

Mr. RHODES. Will the chairman yield?

The CHAIRMAN. Yes.

Mr. RHODES. Colonel Hedger this morning was arguing that if you denude a slope, take the brush off, you get so much water you have a flood danger.

Mr. GREER. You do.

Mr. RHODES. If that is the situation and you are really after high water production, it seems to me you are working against yourselves by keeping the brush. It may be you are going to make a problem for yourself as far as the disposition of the water is concerned. Maybe you will get too much. But would not that be a lovely problem to deal with?

Mr. GREER. No, because if you remove the brush and get one of our peculiar rainfalls here—we do not get them often, but, when we do, they just gouge and gut out a whole canyon and all the lowlands in front of it and ruin it; you have a lot of water and it runs into the ocean.

Mr. RHODES. That was my point: You are going to have to do something about taking care of the water. But at the same time, is it not

working against the highest and best use of this watershed to keep this brush up there from now on and not increase the production of the watershed, of that commodity, of the highest and best use, which is water?

Mr. GREER. Did I understand you to say you wanted to remove the brush from the watershed to get more water?

Mr. RHODES. I do not want to remove it right now, but I think as soon as you can remove it and substitute a grass cover for it you are going to increase your water production and still not increase your erosion. Is that right?

Mr. GREER. Up to the point the professor just mentioned, When you get land that sits in 40°, 50°, 60°, and 70° and burn the brush off or remove it any other way, and the land is only 2, 3, 6, or 8 inches deep, it will not stay there until you can grow grass; it will start slipping on its own accord.

Mr. RHODES. That is recognized, but I misunderstood you. In other words, I think we probably agree that where you can grow grass you ought to take off the brush, but where you cannot grow grass you ought to leave the brush to hold the soil.

Mr. GREER. That is right. On the low rolling land we have no objection. For instance, in our county this week they just finished a 10,000-acre burn to make better grazing land, but it is not the type of land you have been discussing in the watershed.

Mr. RHODES. There is no doubt but what even brush is better than having the soil completely denuded.

Mr. GREER. That is right.

The CHAIRMAN. The subcommittee will stand in recess for 10 minutes.

(A short recess was taken.)

The CHAIRMAN. The subcommittee will be in order.

I want to ask one further question here. I want to ask Mr. Nash-Boulden, retired supervisor of the Los Padres National Forest, if he and Mr. Greer see eye to eye on this matter. Or do you think controlled burning can be made a proper instrument?

Mr. NASH-BOULDEN. In certain areas I do, yes.

The CHAIRMAN. But not on steep hillsides where all the boulders and muck can be dislodged by a flash rain?

Mr. NASH-BOULDEN. That is right.

The CHAIRMAN. From your experience in Los Padres National Forest, what would you do to limit the size of fires?

Mr. NASH-BOULDEN. Well, the first thing to do is to make a study of those areas that one of the gentlemen mentioned awhile ago had a reasonable amount of soil on it, and there are lots of them, and there are a lot of slopes away from the steep slopes running 30 to 40 percent which could be burned by some fast work, of course, so that when you get a wildfire you have some place to work backfire from. A narrow fireline has been proven time and again to be ineffective, even from backfiring, because the heat is too terrific, and often they are not placed in such a way that you can get far enough back to be safe with your men for backfire.

The CHAIRMAN. How many years were you with the Forest Service?

Mr. NASH-BOULDEN. Thirty-four years; from 1913.

The CHAIRMAN. When were you appointed supervisor of Los Padres National Forest?

Mr. NASH-BOULDEN. In 1929.

The CHAIRMAN. When did you retire?

Mr. NASH-BOULDEN. December 1947.

The CHAIRMAN. You think perhaps we could create islands in these vast areas of brush?

Mr. NASH-BOULDEN. Islands or strips, yes; wide strips. When I say "strip" I am thinking in terms of a half to three-quarters of a mile to be burned out.

The CHAIRMAN. You would select those on soil that was susceptible of growth by other kinds of cover?

Mr. NASH-BOULDEN. And slopes.

The CHAIRMAN. And not susceptible to high erosion due to its steep slope?

Mr. NASH-BOULDEN. That is right.

The CHAIRMAN. How long have you been retired from the Forest Service?

Mr. NASH-BOULDEN. I retired December 1947.

The CHAIRMAN. I want to ask somebody before this thing is over with if there are any plans afoot to do the kind of business the gentleman from Florida, Mr. Haley, mentioned.

Mr. HALEY. Mr. Chairman, I am not going to get tangled up here with this bunch of experts, because they probably know more about the situation here in 5 minutes than I would know the rest of my life.

I was a little disappointed, Professor, when the chairman was trying to make out a case for my Indian friends. I say "my friends" because I happen to head the Indian Affairs Committee in the Congress, and normally everybody is blaming them for everything that has happened. I was a little disappointed in your saying that. Those were about the first kind words I have had out of him since I have been out here in California from Florida, and then you immediately sat right down on that.

I would like to ask someone here this question for what may be a little enlightenment on this situation:

On page 2 of the report—and I believe, Mr. Nash-Boulden, you are taking care of this—in item 6 you say:

The Forest Service will be freer to conduct controlled burns if legislation is passed to remove the liability for negligence in fire fighting which was imposed January 28, 1957, by the United States Supreme Court.

Of course, I am not surprised at any ruling that you might get out of the present Supreme Court of the United States, but I believe the gentleman, in testifying, said that this liability applied to the individual. Did I correctly understand that? Is an individual man in the Forest Service, if he sets a fire to destroy a fire—I am not familiar with this decision—is he personally liable for damage? Can anybody answer that?

Mr. NASH-BOULDEN. It is my understanding that anyone having their property burned under those conditions is able to sue the individual responsible, and in the present courts, as you know, they sue for tremendous damages, as they do in automobile damages. They are more conscious somehow. We used to backfire years ago and give no thought to that. Now people are so conscious of getting easy money that if they cannot sue the Government or the State, they sue the individual personally. It has caused a deterrent in many cases because a man is afraid to start a backfire. That is my understanding.

Mr. HALEY. Do you mean to say in this particular case you were speaking about when you were testifying that an individual is held liable for the destruction of property when acting under orders of the proper officials of the Forest Service?

Mr. BRELSFORD. Mr. Congressman, that case did not so hold. That case held that the United States Government was liable under the Tort Claims Act for liability, and there was no statement made as to the liability of the individual.

Now I attempted to quickly check out the law on the liability of the Federal employees for negligence in their fire fighting, and I have found no ready reference to any liability. However, in municipalities, which, of course, are exempt from any liability, individual firemen are liable for their negligent acts in fighting fires. And there is now a belief throughout the Forest Service that they personally can be sued if they are negligent or issue orders negligently for fighting fire.

Mr. HALEY. In other words, what you are saying to me is that where you have a State, a county, and a Federal fire-fighting organization here, the ranger in the employ of the Federal Government would not be personally liable for negligence or for destroying property, but the fireman, for instance, working more in the county or district, whatever it happened to be, could be held liable for damage caused by setting a backfire under instructions from the district; and, if he is not liable, then the district itself would be. Is that right?

Mr. BRELSFORD. That I am not prepared to state. I attempted to locate that law as it applied to Federal employees, and I could not locate it. Either there is an absence of it or I missed it. I do not know which. But whenever the employer, the United States Government, is liable, even if the individual is not liable, the finger gets pointed down the line, and it has a deterrent effect regardless of whether that individual is personally liable or just the Government or unit.

As I mentioned, the other units of government are exempt from liability, the municipality, and, I suppose, the county, and the State. I do not know, though, on those.

Mr. HALEY. You are speaking on behalf of the Federated Sportsmen of Santa Barbara, Calif. Have they made any recommendation for legislation that would probably cure this?

Mr. BRELSFORD. Yes. That is our recommendation on page 1, recommendation No. 2, that this committee seriously consider lifting liability from the employees and possibly from the Federal Government itself, depending on our policy concerns. We feel that no program of controlled burning will be effective if the individual has to worry about his liability, because they are so worried now when they fight fires that they often do not even set off backfires. Then if you go out and deliberately set a fire, which is what you are doing with controlled burn, the liability is pretty well established as to the ordinary individual, that they are liable.

I think that would be such a deterrent on these employees that you could get very little effective controlled burning done without such exemption.

Mr. HALEY. I can see you have a very good point there. As I say, I hope the committee counsel will look into this situation. I can see where it would be quite a deterrent to a man who might personally

be liable or at least have some responsibility so that he probably would not enter into this thing wholeheartedly.

As I say again, I am not too much concerned about any decision rendered at this late date in the history of our Supreme Court.

I think that is about all.

The CHAIRMAN. The gentleman from Pennsylvania, Mr. Saylor.

Mr. SAYLOR. I might say to my good friend from Florida that we survived a good many decisions of the Supreme Court, and we are going to survive these.

Mr. HALEY. I am glad to hear that.

Mr. SAYLOR. I am not worried about that. We will get over them. Maybe I do not like some of them any better than you do, but we are going to survive them.

First, I apologize for not being here, but my colleague Mr. Shuford had some problems, and I was trying to help him out in a strange land. It is surprising what you can learn out here in 3 weeks in helping people to get along.

The CHAIRMAN. You evidently lost him because he did not come back.

Mr. SAYLOR. I would like to ask any one of you four gentlemen whether or not you feel the Department of Agriculture has a special problem here in southern California and in some of the other Southern States where we have forest areas, in that they are trying to apply an overall policy to the Forest Service whereas the forests are different in type and might require special regulation. By that I am not trying to put anybody on the spot, but let me show you what I mean.

In Germany you do not find too much instance of this fire danger because in many areas they have gone in and have carefully managed forests. In some sections it is as clean as many living-room floors, because they have gone in picking up the limbs that fall off, seeing to it that the brush is done away with so that it is clean.

Might there be certain sections and certain forests in this country which would require that kind of treatment, having as its principal aim prevention of fire?

Mr. GREER. Mr. Saylor, that was the basic idea of the Watershed Fire Council of Southern California. They discussed this with the Federal Forest Service and State forest service, and everyone agreed there was a special type of situation here and it required a special type of program, not the type that is needed up in Congressman Engle's district in the high Sierras, not the type of thing you find in Florida and in some of the Southern States.

That program has been worked over and hashed over from all angles and finally settled upon. It may not be the perfect program, but it is the best of all of the knowledge of all of the people who were supposed to know.

We speak of these forests. It is very misleading. There is very little in the way of forest trees in these areas. There are patches here and there, some at high elevations. But the part that concerns us is this brush-covered land. No one yet has come up with a complete solution as to removing the brush and getting something else on the land without having floods and erosion. I am speaking of the steep slopes.

I think everyone is living in hope. The research station over here has done a lot of work, as they have done in the central part of the State, but much more needs to be done.

Mr. SAYLOR. Let me ask this question: I notice in one of these statements that you gentlemen have submitted the statement that if it is your grass it uses a certain amount of water, if it is brush it uses a great deal of water.

What would be the effect if the Forest Service stepped in and got rid of the brush by either chemicals or manual labor, pulled it out and then reforested it? What would the effect be in those areas? Would that solve your problem or would it tend to solve your problem?

Mr. GREER. On the lowlands, I believe, where slopes are not too steep and the soil is deep enough. But you cannot do much, as th professor said, with these lands that have just a few inches of soil on top of rock. You get monkeying with that land and you are monkeying with nature, and you get into all kinds of trouble.

I think the professor mentioned the fact that just planting grass and getting a good stand and a good growth takes 2 or 3 years, and then the weeds take over, and they are deep-rooted weeds, and it is no longer any good for forage.

They demonstrated that at the Government station up at San Dimas.

Either you have to go in and spray the weeds—and it is pretty dangerous to spray great areas as these sprays drift with the wind and go 60 and 80 miles and land in the fields. And it is very expensive.

We had a case where a man wanted a clean brushout on an orchard within the forest boundaries, but private land. He complied with all of the rules and regulations. By air line I would say it is 24 miles to where my son has a little nursery 80 feet by 80 feet. I can take you up there today and show you instances of those seedling orange trees that were affected. Some weather condition came along and picked the spray through the air and it dropped right there. It was not serious, and they have grown out of it. But if you get into some crops it is very serious and the man loses the whole crop.

So everybody is hoping. I think more will come of that, out of research.

Mr. SAYLOR. Let's be frank about it. The Germans have kept their forests going and kept that continent going over there with their forests. We certainly are not going to concede the Germans who came over here were the ones that did not have too much savvy and know-how. We did not leave all the smart ones over there to go over to Russia, did we? I hope that we brought some of the smart ones over, or they came over here.

It has been my understanding that most of the smart ones came over here. That has been my hope anyway.

Mr. SAMPSON. I believe it is true the Germans in Germany can spend a tremendous amount, spend more on the production of wood than we can. We are limited in our expense in a silvicultural way. They can afford to spend a great deal more in keeping their forests open.

Mr. RHODES. And also the amount of money you have to spend to get a worker to work 1 day over there is somewhat different than the amount you spend over here.

Mr. SAMPSON. That is right.

Mr. GREER. There is another thing I think goes with that. I know during the First World War you saw all the Germans and French

people go out in their forests and pick up, as you mentioned, all the twigs and the limbs. They carried them home, and they went into the kitchen stove that cooked the meal and heated the house. I do not know how many people you could get to climb up this mountain to bring a load on their back down to have a little heat in their house.

Mr. SAYLOR. I am afraid someone might freeze to death before they did that.

That is all, Mr. Chairman.

The CHAIRMAN. The gentleman from California—Mr. Sisk.

Mr. SISK. Mr. Chairman, I want to commend all of these gentlemen on a very excellent statement. I could discuss for the next 2 hours, I think, some of the statements they have made.

I would like, first, Dr. Biswell, to discuss with you a little bit something with reference to this prescribed burn situation. I realize that is not, let us say, particularly applicable to southern California.

Mr. BISWELL. Yes, I think it is, at higher elevation.

Mr. SISK. It realize there are possibly some high elevations where it would be applicable. But in my particular area you mentioned specifically Ventura County. I am familiar with that. I have been all through that area.

I am curious to know, under your experience with prescribed burn, how much of California's forests do you feel would be adaptable or where, for example, the topography and soil and weather and other conditions are, let's say, similar to that situation and where it might be applicable.

Do you feel there is any particular percentage of California forest areas in high elevations would be adaptable at all to this program?

Mr. BISWELL. I think practically all of the ponderosa pine forests where the ponderosa pine produces a layer of needles on the ground. I mentioned the layer of needles on the ground is the most important situation. So it might be applicable to all areas of ponderosa pine that produce enough needles to carry the fire on the ground, and the slope does not have very much to do with it. It is just as important to keep a low fire hazard on a slope as it is on level ground. So, if you have a slope, you ought to be sure to keep a stand of trees there and keep a soil cover of pine needles.

It depends upon how many acres of ponderosa pine we have that will cast a layer of needles on the ground. Maybe some of the Forest Service people can tell better than I, but I think probably half a million acres, 400,000 acres of ponderosa pine is faily well stocked.

Mr. SISK. In your discussion you mentioned this light burn, and I believe you suggested that it be done on, say, 2 or 3 occasions. In other words, you burn a little bit at a time in order to keep down the heat of the fire.

Let me ask you this:

In view of the fact in our forests we are attempting to keep on a sustained-yield basis, and it is our desire that hereafter we shall never permit the recurrence of complete deforestation of great areas of our country, and we want to keep the trees coming on for posterity, what will your program do for the regeneration of these trees?

To what extent will that be effected? That is a vital, important subject before us.

Mr. BISWELL. In this program I am working out a complete national-forest program where we consider timber, water, wildlife, soil

erosion, everything, low fire hazards, a principal tool of management is prescribed burning.

The way I do that is when I get to the end of the cutting cycle, which will be with trees 120 years, then I cut out in spots as the Forest Service is doing—clear-cut out in spots of ponderosa pine and re-establish the forests.

So you should get a new stand of trees, say, within 5 years after you make this final cut. This can be a small spot.

Mr. SISK. Wait just a minute——

Mr. BISWELL. In these young trees it is absolutely essential to keep fire out until those trees get tall enough and until enough of a layer of pine needles is on the ground and you can ease fire through them. From then I do not want a single fire in the forest. I have my crop of trees, a fully stocked stand, and my purpose is to manage, to harvest cut every 15 years or so.

If we have a pulpwood market we can start harvesting the forests every 15 years or so, and finally end up with a stand of big trees, 30 or 40 per acre, cut those out, regenerate and start over.

So, theoretically, if you have 3,000 acres and if it takes 100 years to grow a stand to maturity, you would clear-cut 30 acres per year, and you will regenerate those 30 acres. You would have 30 acres each year right up to a hundred years, and would have all ages in this forest.

When you have a ponderosa pine forest with young trees and understory—and in certain areas other kinds of trees will readily regenerate under the ponderosa pine. For instance, the cedar and white fire. When that happens you have a fuel structure that is very dangerous. You have young trees under older trees, and you have competition. The old trees suffer from this competition, and you have the fuel all the way from the needles right on up, and it is a very dangerous fuel situation.

So, then, what I do is to establish a stand of trees on this 30 acres, keep the fire out until I could ease fire under them and manage it right on through.

Mr. SISK. Dr. Biswell, your knowledge of this subject is far greater than mine. Probably you have already forgotten more than I will probably ever know. But these statements are replete with phrases along this line: it is dangerous to fool with nature, and nature's way possibly has had some advantages in this great forest of the North American Continent, which grew here and developed under conditions which we are not too familiar with but which you gentlemen, through research, have analyzed and so on.

Certainly, if I understood your program—and maybe I do not; I am not necessarily disagreeing with you; I am just trying to get it through my head—you are certainly playing with nature there, because that is not the way these forests have been developed and regenerated over periods of hundreds of thousands of years, is it?

Mr. BISWELL. I think so, yes. Precisely the same way—and the program is based on that. Yes, the way the ponderosa pine forest regenerates is in an even-age group, and that is the type of forest we have got.

Mr. SISK. In other words, then do I understand that this leads you to believe your work in the background and history of the forest—and,

of course, you are talking only of ponderosa at this moment—believe that the forest grew and finally matured and was harvested or destroyed, going back several hunderd years ago, and a wholly new forest grew up? Is that right?

Mr. BISWELL. In this spot, in this even-age group or spot, that is exactly right. And the way that happened, the entomologists and so forth tell us we always have bug infestations. There were a lot of trees killed and they fell over, and they got very intense fires in there, and finally the frequent fires I showed you burned all of this up, and that area regenerated back in.

These natural fires from lightning and the Indians—and I do not know much about the Indian burning, but the lightning storms occur chiefly in June and August, those two times. So these areas, after they were burned up and the debris burned up, then they would not burn for a period of years because the forest had been destroyed, and the pine needles, which I say are so important, were not there to carry fire, and, so, those spots were missed.

So here [indicating] a fire came along and burned under the forest where there were pine needles, and when it hit this spot where there were no pine needles the fire went around and we had this new stand develop. That is precisely the same way.

Mr. SISK. We have two schools of thought apparently. At least I have noticed this. I have questioned the Forest Service people specifically on it, and out in Oregon or Washington or maybe both States they have a procedure of cutting similar to what you are talking about. I noticed they go in and cut it solid, clean off a section of land or whatever the area of land may be.

Down in my area, the Sierra Nevada area, which you are familiar with, through there they are not doing that; they are going in and making individual selections and operating on a sustained-yield basis, as I understand, and maintaining that forest perpetually by taking out the trees that are mature and ready for harvest, and leaving the others to keep coming on. It is a continuous round.

So if we are going to work on that basis, your program would not work then. Am I right or wrong?

Mr. BISWELL. I am working out a program whereby I can operate with low fire hazards. I do not think you are going to operate with low fire hazards.

Mr. SISK. Pardon me.

Mr. BISWELL. I say under the program of selective cutting in ponderosa pine, actually ponderosa pine does not regenerate very well under ponderosa pine, and under selective cutting you get into all of these other plant exceptions, and you are going to continually have high fire hazards. I do selective cutting all the way. All the intermediate harvests are selective cutting. I do selective cutting all the way through, but when we get to the end we have 30 or 40 trees fairly well spaced, nice specimens. I cut them out and regenerate.

I think the Forest Service is doing essentially the same thing on ponderosa pine. They call it unit area control, where the cutting is based on forest stands, and if there is a stand here that needs to be cut they do it, and they regenerate it.

Mr. SISK. I appreciate very much the discussion, Dr. Biswell. I am very much interested in that, and I appreciate your comments.

I would like to ask you, with reference to your experience, if you have had any experience with reference to burns in areas such as this Los Padres National Forest up here.

By that I mean—and I might say this to Dr. Sampson also—to what extent have you experimented or tested in that area or a similar area where it is primarily all brush or no timber, taking areas where the slope, let us say, is below 40 percent or 50 percent? I do not know where the margin might be there and where erosion might set in, from 20 to 60 percent, or where it might be. But have you made use of selective areas in which you have gone in and burned those areas off? And can you give some data as to what you found to be the results of those burns on, let us say, the more sloping areas, the more flat lands and so on?

Mr. BISWELL. My nearest approach to those brushlands there is in mixed Chamise-chaparral in Lake County where Chamise is the principal species on south exposures and other types of brush plants are found on north exposures. So there we can go into those areas in the springtime and burn the south-facing exposures or Chamise in the springtime when the grass on the outside is green, and the fire will burn to the top of the slopes and go out. Because the difference in conditions between the north and south exposures is so great, the south will burn and the north will not.

You have to select your time when you do that, and then burning it depends on the purpose for which you are burning. If you are burning to convert to grass for livestock, it is one thing; if you are burning to maintain grass for game, it is something else.

So that, if you want to talk about benefits to game, we found that the deer population is greater where we keep the brush younger, and there are more deer there. Some of these areas are heavily covered with brush. The grazing value for livestock is increased if it is converted to grass.

One thing about the conversion process is that I am always a little amazed how well grass will do if the brush is taken out.

Mr. SISK. The point I had in mind, which I am particularly concerned about, is in southern California, this very area here we discussed with the Forest Service people this morning. There are areas where, of course, I realize, due to the very steepness and type of soil or where there is no particular soil, very rocky, it is not practical. But it seems to me there are large areas over here where it is much more rolling, where the grade is, say, 20, 30, or 40 percent, where there is some soil and it could be burned and, through reseeding, could immeasurably help in the control of forest fires in this area, by giving them an opportunity for backfire and by doing a great deal.

The idea just expressed here this morning that it is just impossible and we cannot do any control burning I do not agree with at all. I do not think the gentleman meant to say that in so many words, but I think some of them are a little adamant in doing any burning in this area.

I would like to have you comment on that, Mr. Biswell, or any of the balance of you as far as that goes.

Mr. SAMPSON. I might add this point, that on the Malibu burn the State division of forestry did some grass seeding very shortly after that fire.

Mr. SISK. After the burn?

Mr. SAMPSON. After the burn. And they have established a fairly good cover on the soils that were moderately deep and where the grass, for some reason or other, took hold. So they feel rather encouraged that they are pinning that soil down by virtue of the grass cover that has been established.

So there was a case where you had moderate slopes where they reseeded and are establishing a grass cover to some degree at least.

Mr. SISK. We had a statement here from, I believe, the gentleman representing the Federation of Sportsmen—I am sorry, I did not get your name, but I believe Mr. Nash-Boulden is here representing these people—in which you at least indicate, as I recall, very grave hesitancy on the part of the Forest Service to do any burning at all in these brush areas.

If you have any evidence, any of you, to sustain a position that controlled burns in the rolling areas, the flat areas, the areas where there is sufficient soil on top of the rock to raise grass, should not be done, I think it should be brought out, because I know it has been successful in some areas in the eastern foothills of my own area, in the area Mr. Biswell already mentioned.

Mr. RHODES. Will the gentleman yield?

Mr. SISK. Yes; I yield.

Mr. RHODES. I would like to ask this gentleman this question: How many other sportsmen associations, such as the Izaak Walton League, support your opinion as to control burning? Is it pretty unanimous by sportsmen?

Mr. BRELSFORD. I think it is pretty well fixed throughout the general population in our area. You have the telegram from the Cuyama sportsmen group, which is in the north end of the county.

I have not talked personally to the other sportsmen's groups in our area, but I am quite sure they feel that way. The entire populace is pretty much of the idea there has been a head-in-the-sand attitude, without opening it to examine this strict no-burning policy which has been in effect about 40 or 50 years.

I am very surprised to learn here today that the Forest Service had burned any areas in a controlled burn in California, because our research had indicated they had done none and were advocating against it to this very day.

Mr. SISK. I might say to my colleague from Arizona that I think there is some considerable difference of opinion even in the Forest Service on this. I say that with due respect to the Forest Service because I have a very high regard for them and the job they are doing. Nothing that I say is intended as criticism.

I think probably in your area you may have some boys in the Forest Service who, let us say, do not see eye to eye with some boys in other areas in the Forest Service. They have done some control burning, quite a bit of experimentation with control burning, up in my own area.

I am particularly concerned because we had apparently reached an agreement this morning that there was not anything we could do to keep fires from starting down here, and we had to have the brush. Colonel Hedger—I do not know whether he is still here—seemed very adamant about any type of burning.

What I am asking you, gentlemen, is to expound, if you will, on whether or not any areas—you mentioned Malibu. We were led to believe this morning nothing in the world could be done in Malibu. Certainly if even small areas could have been used for backburning, it could have been of tremendous value. I would be glad to have your comments.

Mr. GREER. There were a few burns in Santa Barbara County, 70-some thousand acres. It was all reseeded, both the private lands and the Federal lands. And the lower privately owned lands—in fact, all of it—had a fair stand of grass, and it was grazed again this year. But the higher sloping lands have been taken over by wild morning glories and wild cucumbers. I have not been on them, only what I could see from the road, but there are people back in there that tell me that they are so thick there is no use trying to walk there. It is just a tangle.

Mr. SISK. That is in your extreme steep slope area?

Mr. GREER. Not our extreme steep slopes. It is steep, but I would not say it was the extreme. The variations are so great there. You have some that stand almost on end, then it goes a little flatter and then it stands on end again. It is such a complicated thing.

I agree with Nash-Boulden. I do not know how many areas you could find, whether an extensive amount, that it would pay to burn if the Federal Government, on checking out, thought it was dollar-wise.

The burn they made last week, 10,000 acres, on so-called rolling land was not cheap. They are about decided, so they tell me, members of the cattlemen's association, that they do not think they can burn all the land they used to think they could burn and put back into grass. Dollarwise it was not worth while.

Mr. SISK. I appreciate it is an expensive process because I have seen the figures on the San Joaquin experimental range on that. However, when we consider the damage done by fire, particularly in the Malibu, and in some cases where they had both loss of lives and loss of property and things like that, the cost of that becomes relatively unimportant. These small areas that might be reseeded, even though they be small, to furnish safety zones which might save a man's life, as well as furnishing areas in which the fire could be fought or held or backfired, I think are very important.

I appreciate the time, Mr. Chairman. Thank you. I will conclude with that.

The CHAIRMAN. One further point, Professor Sampson. You made a statement earlier today that you studied why a tree grew in some particular place. Tell us why brush is the dominent vegetation in southern California rather than trees or grass.

Mr. SAMPSON. I think there are a number of reasons for that. One is the fact that we do not get a very large rainfall per year. The other is that we have this long period of drought covering a number of months. But very hot weather and thin soils on top of that. And, as I have said, to maintain a grass cover requires from 15 to 18 inches of soil as a minimum.

The sprouting type of brush can grow and maintain itself on a relatively thin soil. Its growth requirements are not nearly as high as many other kinds of plants. For instance, the nonsprouting brush

you do not find here in this area extensively because it does require better growth conditions.

So here we have something that can occupy the area without too much competition from the outside because of vegetation, and so we have this fire type of sprouting brush.

The CHAIRMAN. Thank you very much.

Mr. RHODES. Will the chairman yield?

The CHAIRMAN. Yes; I yield.

Mr. RHODES. Doctor, I think it was said this morning they were working on a fire-resistant type of brush. Do you know whether that is a feasible sort of thing, or whether there is any such thing, or whether there could be any such thing as a fire-resistant type of brush?

The CHAIRMAN. In other words, asbestos brush.

Mr. SAMPSON. I will answer that this way, that not all species of brush are equally flammable. Some species have much more moisture in them, and the structure of their leaves, the thickness and all, is so different that some will ignite quickly. dry out quickly when the heat comes along, whereas others will retain their moisture sufficiently to not burn.

I do feel we should explore this field of brush which is less flammable than that which we have for the most part. It is going to be a difficult task to find something that is suitable because, in the first place, we do not want a poisonous species on account of livestock. We do not want a plant that is going to get out of the brush fields and then on the grasslands and even on farmlands, such as has happened in Australia and New Zealand and in the islands. They have paid very dearly through the nose, so to speak, because of introducing weedy brush species.

I nevertheless feel it is a very fertile field of research, and I know the research organizations have it very much in mind and we can expect, I think, some advancement in this particular phase of the work.

Mr. RHODES. Mr. Chairman, I think the panel has done an amazing job. I certainly want to thank each and every one of you for the fine presentation.

The CHAIRMAN. The Chair joins in that for all of the committee.

Thank you, gentlemen, very much for your informative and helpful testimony.

Is Chief T. William Heidner of the City of Pasadena Fire Department here?

Mr. HEIDNER. Yes.

The CHAIRMAN. Chief, do you have a short statement to make to the committee?

Mr. HEIDNER. I have, Congressman.

The CHAIRMAN. Tell us something about the fire problems of Pasadena and whether you get out in the brush area.

STATEMENT OF T. WILLIAM HEIDNER, CHIEF, CITY OF PASADENA FIRE DEPARTMENT, PASADENA, CALIF.

Mr. HEIDNER. Thank you, Congressman Engle. I do not have a prepared statement at this time because I misunderstood that there would be just a verbal statement.

Pasadena has several boundaries that are integral with the Forest Service. In fact, part of the city of Pasadena is well within the Federal Forest Service in the San Bernardino Mountains.

We have been very happy with the cooperation that we have received from the Forest Service. We interchange services, exchange personnel for training purposes, and the cooperation has been wonderful in that respect.

We respect the Forest Service for their knowledge and ability in brush fire fighting. Basically the city of Pasadena trains on structural fires. We do not put ourselves out or hold ourselves up as being experts in brush fires, and so we depend upon the Forest Service and Los Angeles County to assist us in that area. We, in turn, have worked with them where they have structural problems. In many of their training programs we have worked together in their training schedules.

We do feel that the necessity of better protection is great in Pasadena and the hills behind us, because our watersheds are in that area, and the protection of many of our homes depends upon that watershed being properly covered to prevent floods.

You have probably heard from several other people here in this meeting that we have had disastrous floods in the areas behind Pasadena. Sierra Madre and several areas behind us have the floods due primarily to fires that occurred previous to that time.

So we are naturally quite interested and particularly worried about any fires that may occur in that brush area immediately back of Pasadena.

We have other brush areas in the area which is a tie-in between Glendale and Pasadena, and we try to maintain that area with fire protection and fire prevention rather than other methods of clearing the area of brush. We feel that would be an impossibility. We feel it would be very impractical because of the erosion that would occur should that brush be cleared off.

In fact, that has happened just by clearing firebreaks which we use as a means of ingress to brushy areas for fire suppression work. They do not stop fires, but they allow us ingress to the areas in order to fight the fires. Just putting in small firebreaks has created tremendous erosion problems. We have had to worry about getting the water down off those firebreaks and into the brush area before it gets into the building or structural areas.

We also find that it is very important that trained men are on the forests and in the fire-fighting field. That is one of the most important things I think we have learned over the past years, that training is the most important thing.

We feel that the Forest Service, because of the peculiarity of their manpower, where they have seasonal manpower, have been hindered many times in their work in the forest-fire fighting. We work in with these people quite often, and you can notice the difference between the individuals who are there for just the summer and the men in the Forest Service who have given their lives to this service, or in the upper brackets, dedicated to the job. It is just a different type of individual entirely.

In the city's fire department a man usually does not come into the service with the idea of working for just a summer, for a year

or two, and then going into something else. He comes in with the idea in mind of being permanent, and he wants to make that his livelihood. So he dedicates his service from the very beginning. Possibly that is one reason we have difficulty in securing the right type of man for the job in our service.

We have to be very careful in selection, and we spend a great deal of money in training these men. We just do not dare lose them after we have trained them to become especially good firefighters. For that reason probably our salaries or our working conditions are different, higher than for the Forest Service, working conditions and salaries. I do not think we could operate under the same circumstances that they do, or the same conditions. In fact, it was tried in 1928 and 1929, somewhere around there, when we tried hiring men for just a summer season to do nothing but fight brush fires. It was discontinued within 2 years because of the type of man that worked on that basis, he being not the type of man that gave a great deal of study to fire suppression.

I am saying this from the standpoint of the fact that we have received wonderful cooperation and worked well with the Forest Service, particularly the upper echelon in the Forest Service, because they speak and think forests and fire fighting the same as we do. When we work with the men who are on the firing line, many times they do not have that same feeling that we do.

As I said, this is not a written statement; it is just off the cuff. There are probably many questions you would like to ask, and I would be very happy to answer them if I possibly can.

The CHAIRMAN. You do have boundaries that are adjacent to the national forests in the city of Pasadena?

Mr. HEIDNER. That is correct; some well within. In the Angeles crest area we have a section of the city of Pasadena watershed that is 15 miles outside of the city of Pasadena. In order to get to it you practically have to go through Los Angeles County and up into the forest.

This area on the Angeles crest and also our canyons behind Pasadena that are a part of the Pasadena watershed, there the Forest Service covers four of them. We assist them, but we allow them full control of those areas because of their better knowledge of fire fighting in that type of terrain, and we are very happy to have them take that over, because we look to their knowledge for the fire suppression work.

The CHAIRMAN. Are there any questions?

Mr. Haley?

Mr. HALEY. No questions.

The CHAIRMAN. Mr. Saylor.

Mr. SAYLOR. Chief, the question I am going to ask you I probably should have asked somebody this morning because I do not want to appear to put you on the spot, but it did not occur to me. If you do not know or do not want to answer, you just go ahead and say so.

Out in this area where water seems to be such an important subject, have the cities which are here adjacent to the ocean used salt water for their fire-fighting purposes, or do they use fresh water?

Mr. HEIDNER. There are many areas that do use salt water to augment their fire-fighting water supplies, but there has to be a separate

main system in order to do that. Otherwise it would get into the domestic supply.

San Francisco does have places where they use that, and many other areas, by putting fireboats on the wharfs and pumping from them into the pumpers on land. That is quite commonly used where you have available water supply.

Mr. SAYLOR. That would work for a comparatively short distance close to the shore?

Mr. HEIDNER. That is correct.

Mr. SAYLOR. But where you get into areas such as you have described as being 14 miles away from the city boundaries, you would have a hard time doing that. Is that right?

Mr. HEIDNER. That is correct.

Naturally, in the heavy brush areas it is impractical from a financial standpoint to run mains into an area where there is very little domestic use. Those areas you may have to streamline for a mile or 2 miles, but that would be just about the maximum you would dare get into a territory of that type.

We do many time lay lines to support tankers and so forth, but you have a limitation there very definitely.

Mr. SAYLOR. Thank you. That is all.

The CHAIRMAN. Are there further questions?

If not, thank you very much, Chief. We appreciate your taking the time to come down. Your testimony has been helpful and informative.

Mr. W. B. Carter, chairman of the Watershed Fire Council of Southern California.

Could you make your opening statement in the remaining 15 minutes and then return tomorrow for questions?

STATEMENT OF W. B. CARTER, CHAIRMAN, WATERSHED FIRE COUNCIL OF SOUTHERN CALIFORNIA

Mr. CARTER. I would be very happy to, Mr. Chairman.

I have a prepared statement, but I was not going to give it out today as I have a couple of corrections to make on it. If you would like it now, I can tell you what the corrections are.

The CHAIRMAN. You go ahead and make your summary statement and deliver the statement tomorrow.

Mr. CARTER. I am going to make the statement from what I am going to give you.

The CHAIRMAN. Summarize it and deliver the prepared statement tomorrow.

Mr. CARTER. The first portion of this statement will be written, and I will pass these out tomorrow. They will contain a statement of the economic situation in southern California, number of residences, and so on. You will have those, and I will answer questions on them. Most of those have been covered by previous testimony. So I am not going to bother with them now.

The first table I have on here is in connection with the southern California fire plan, the 10-year program of adequate protection for the national forests of southern California.

The CHAIRMAN. Before you go further, would you tell us a little more about the Watershed Fire Council of Southern California so we could identify you and your background and activity?

Mr. CARTER. Yes.

The Watershed Fire Council of Southern California is a citizens' organization made up of representation from areas representing the four southern California national forests—the Cleveland by the San Diego study group; Orange, San Bernardino, and Riverside Counties by the tricounty group representing the San Bernardino National Forest; the Watershed Commission of Los Angeles County representing the Angeles National Forest; the Ventura, Santa Barbara, and San Luis Obispo Counties representing the area of the Los Padres National Forest.

The watershed fire council is a coordinating group, coordinating the activities of those four southern citizen groups. I am the chairman. The organization operates by its minutes, and therefore I could be deposed at any regular meeting of the organization.

A program to provide adequate standards of fire protection for southern California national forests has already been developed. This program reflects actual needs of the United States Forest Service. It was prepared at the request of, and has been fully adopted by, the Watershed Fire Council of Southern California and its member groups.

It calls for the expenditure of $2,375,000 per year over and above regular appropriations provided for fire protection in southern California during fiscal year 1954, for 10 years to provide sufficient numbers of yearlong fire-fighting crews and other personnel, the purchase of new and badly needed fire-fighting equipment, building of fire trails and breaks, construction of additional fire crew camps, water stations, and other structures, building of heliports, and putting into effect preplanning programs and other projects of a fire-prevention and presuppression nature.

The table you will have tomorrow will give you the breakdown for the four southern California forests, showing the operation and maintenance, the capital investment parts of this program.

On operation and maintenance the dollar estimates for operation will employ, train, equip, and house 750 vitally needed additional firemen.

On capital investment, the dollar estimates will permit the construction of the firebreaks, roads, trails, water developments, and heliports vitally needed to enable the increased forces to operate effectively to provide adequate protection. These increases will also permit the foresters to complete the preplanning required on all areas to facilitate the prompt control of fires which are not controlled during the initial attack.

The 10-year plan has been implemented in the manner shown by the next table. If we are to get even minimum protection for our national-forest lands the appropriations must be brought up to the 10-year plan total at once. The figures from the Angeles Forest illustrate the point.

The table will show the Angeles, Cleveland, Los Padres, and San Bernardino services and the helicopter project. It shows from 1954 the regular appropriations, and then the regular and special appro-

priations for 1955, 1956, 1957, with the total of $900,000 of extra appropriations that have been given to the southern California forests.

The next table will be a tabulation showing the fire-control expenditures on the Angeles Forest for 11 years from 1946 to 1956, and it will show the total number of fires by the year. It will also show the total area burned. It will show the cost of prevention and increased suppression, and also the cost of fighting those fires.

The figures will show that $4,318,727 was used in the cost of prevention and presuppression. The cost of fighting these fires was $4,212,907.

These figures in no way reflect the tremendous loss incurred above the cost of control in flood damage, structures, water, recreation area, and human suffering.

I would like to point out, too, that the table will show within the last 3 years—1954, 1955, and 1956—when we began to receive additional appropriations, that each year in the past 3 years the amount spent in the cost of fighting fires was less, which the table will show. Maybe 3 years is too soon to say we are gaining, but at the moment the indication is that we may be gaining on the problem.

Also, the next table states the problem which is further aggravated by military-caused fires, especially aircraft. It gives you a table from 1950 on the cost of suppression of military-caused fires.

We are not being critical of the problem, but just to show you it is part of the job and it is part of the thing we have to face in southern California—the aircraft.

The problem is receiving attention at this time and steps are being taken toward a solution.

I might say that the agencies in the Federal Government, those who are fiying the aircraft and controlling the flight of those aircraft, are working together on a sound basis to try to eliminate some of these causes.

Of course, you can see a jetplane crash in some of the inaccessible areas, which I believe you flew over, would certainly cause quite a fire problem.

The next statement has to do with one of the basic things that we think is necessary in the protection of our forests.

The Watershed Fire Council became aware of the inability of the Forest Service to fill positions, and instituted a study of this problem. While this study is not completed, we have already found that glaring difference of salaries, working conditions and opportunities exist in southern California between the Forest Service and other fire agencies.

Then we have a table of comparison between the Forest Service salaries from GS–2 and the Los Angeles County salaries.

As you can see, as has been stated by the people this morning, with the close proximity of these fire agencies, certainly differences in rates of pay become quite an outstanding problem.

This is merely 1 table of 1 instance in the fire service of the question of salaries. I have some other figures I would like to read into the record now, if you want me to. Or I can do it tomorrow.

The CHAIRMAN. Go ahead with it if it is not too extensive.

Mr. CARTER. I qualify myself on this stand as being a merchant and rancher, businessman, if you will.

I have made some preliminary studies as to labor costs in relation to comparable figures of the Forest Service. The information that I gained here was from the department of employment. I will use Edwards, which is an Air Force installation close to where I live.

An unskilled warehouseman, untrained, gets $2.11 an hour; and a laborer, unskilled, gets $1.94.

A fireman starting at Edwards is an S–4. He works a 60-hour regular pay week, but he puts in 72 hours. Therefore, he has an additional 12 hours' pay which he gets for his work. He has a shift differential, and his take-home pay is around $100 a week.

In order for a man in the Forest Service to get a comparable wage with that, he would have to be somewhere in a GS–7 or higher position which my knowledge on the GS series would indicate is in a pretty high bracket of income as far as the Forest Service is concerned.

The firemen at the North American Aviation plant where North American has their own firemen start at $1.81 to $2.11. This is just a fireman, not an engineer or skilled fireman. He works a 40-hour week, has time and a half for overtime, and shift differential. His take-home pay is around $100 a week.

The union scale in the area—and this is in the area of Angeles where we have competing people living and working on both sides where we can compare wages; we find the unskilled construction worker, union scale, $2.50 an hour; truckdrivers from $2.50 to $3.25 an hour.

Using the plant situation, we have the Pacific Coast Works: labor $2.27 an hour. They work a 40-hour week. They have no skilled requirements when they start. They have company benefits and night pay extras and overtime.

California Portland Cement laborers, unskilled, start at $1.88; work a 40-hour week; have time and a half overtime.

The United States Rubber Co. who has a test base in the area, have drivers. Their salaries start at $380 a month with company benefits. Local drivers, that is merchandise deliveries, unskilled, their total pay is $350 to $375 a month.

Skilled workers in television repairing, radio, washers, things of that nature, go from $2.25 to $3 per hour as a general scale, depending upon their abilities.

I have had occasion to go into some of our national forests and talk with some of our people up there, talk with some of the people in the Forest Service. I would like to make a little comment.

I talked to a man in the Forest Service who was in charge of many thousands of dollars worth of equipment, and responsible for the lives and safety of his crew. He had the responsibility for protection and public relations with the citizenry, and he was getting less money than I pay our delivery man on an unskilled basis, and we have a fast turnover in that particular field.

I think one of the important things, as we become acquainted with our people in the services, particularly in the low-scale field of the forestry service, we find a living condition where it is almost impossible for a young man to enter this field if he has any ambition as far as marriage is concerned, because so much of his time has to be spent in the camps. A young man certainly has very little incentive to acquaint himself with the service and join our Forest Service when he

does not have the benefit of the chance of marriage and setting up a home, where he has to spend so much time in the Forest Service area.

Then, of course, the problem on your year-round work where your Service gets good men, they train them, and they spend much of our tax dollars in training these men and bringing them up to the point where they are workable and usable crews in the fire season, and then they are gone, lost to us, and are not back the next year.

I would like to say a word on research. Research is something of great importance to southern California. We have had and supported research on quite a large scale.

The watershed council requests your consideration on these primary points:

One, adequate appropriations to implement the 10-year plan;

Two, a complete study of salary schedules, living conditions, hours worked, and benefits for the Forest Service personnel;

Three, an expanded and accelerated research program in the field of fire prevention and control, including: (a) heavy equipment—cats, 4-wheel drive tracklaying tankers, transports; (b) fixed wing and helicopter aircraft; (c) hazard reductions; (d) fire retardance; (e) small tools and equipment, fast couplings, light hose, et cetera.

I believe that, very briefly, gives you a picture of some of things I would like to bring to your attention, and the other things are written in the testimony.

(Mr. Carter's prepared statement follows:)

STATEMENT BY W. B. CARTER, CHAIRMAN OF THE WATERSHED FIRE COUNCIL OF SOUTHERN CALIFORNIA, AN ORGANIZATION MADE UP OF CITIZEN GROUPS REPRESENTING THE AREAS OF THE FOUR SOUTHERN CALIFORNIA NATIONAL FORESTS: THE CLEVELAND, THE SAN BERNARDINO, THE ANGELES, AND THE LOS PADRES

Southern California is subject to an acute mountain watershed fire problem of the most hazardous nature. A problem found in no other part of the world today and threatening no greater potential loss to life and property.

The conditions creating this situation exists during any season of the year but becomes most acute with the beginning of the summer months and continuing well into the winter season. Hot desert winds combined with extremely low humidity turn southern California forest and watershed cover into tinder-dry fuel ready to ignite into a holocaust at the slightest spark.

Loss of timber, watershed and recreation area added to the staggering cost of suppression is followed by erosion by wind and by water. Floods which can have a greater threat to life and property than fire creates the necessity of spending staggering sums of money by local, State, and Federal agencies.

More than 6 million residents are from 70 to 100 percent dependent upon the controlled runoff and natural basins within the protective boundaries of the Los Padres, Angeles, San Bernardino, and Cleveland National Forests to provied a natural supply of water for home, business, industrial, and agricultural uses. Southern California must conserve every drop of its local water and protect and retain the vegetative cover of its watersheds in order to do so.

The economic stability of southern California is dependent upon water and the protection of its watersheds. Its financial support to the national economy could be greatly curtailed by losses occasioned by fires and floods.

Recreational values which cannot be measured by known formulas also must be considered.

Local agencies have been put under a tremendous load because of the failure of the Federal Government to keep pace with the rising costs of fire protection in southern California.

Citizens groups have been formed in all of the national forest areas of southern California to study and recommend adequate methods of fire protection.

These individuals take time off from their business and work, without compensation, and often at considerable personal expense to themselves to attend meetings, make surveys, and generally work in the interests of increased fire protection for national forest lands.

A program to provide adequate standards of fire protection for southern California national forests has already been developed. This program reflects the actual needs of the United States Forest Service. It was prepared at the request of, and has been fully adopted by the watershed fire council of southern California and its member groups.

It calls for the expenditure of $2,375,000 per year over and above regular appropriations provided for fire protection in southern California during fiscal year 1954, for 10 years, to provide sufficient numbers of year-long fire-fighting crews and other personnel, the purchase of new and badly needed fire-fighting equipment, building of fire trails and breaks, construction of additional fire-crew camps, water stations and other structures, building of heliports, and putting into effect preplanning programs, and other projects of a fire-prevention and presuppression nature.

ADEQUATE PROTECTION FOR THE NATIONAL FORESTS OF SOUTHERN CALIFORNIA—A 10-YEAR PROGRAM

Funds required annually—in addition to fiscal year 1954 appropriations—for adequate protection of national forest land

	Operation and maintenance	Capital investment	Total
Angeles	$515,000	$195,000	$710,000
Cleveland	210,000	102,000	312,000
Los Padres	495,000	325,000	820,000
San Bernardino	348,000	185,000	533,000
Total	1,568,000	807,000	2,375,000

Operation and maintenance: The above dollar estimates for operation will employ, train, equip, and house 750 vitally needed additional firemen.

Capital investment: The above dollar estimates for capital investment will permit the construction of the firebreaks, roads, trails, water developments, and heliports vitally needed to enable the increased forces to operate effectively to provide adequate protection. These increases will also permit the forests to complete the preplanning required on all areas to facilitate the prompt control of fires which are not controlled during the initial attack.

The 10-year plan has been implemented in the manner shown by this table. If we are to get even minimum protection for our national-forest lands, the appropriations must be brought up to the 10-year plan total at once. The following figures illustrate the point:

	Fiscal year 1954 regular protection and maintenance [1]	Fiscal year 1955		Fiscal year 1956		Fiscal year 1957	
		Regular [1]	Special [2]	Regular [1]	Special [2]	Regular [1]	Special [2]
Angeles	$184,200	$184,500	$67,500	$184,800	$182,300	$198,500	$245,600
Cleveland	138,800	135,900	37,500	135,700	93,700	144,600	124,800
Los Padres	202,700	198,800	52,500	197,900	167,600	207,100	231,200
San Bernardino	165,500	160,700	67,500	160,600	156,400	168,600	205,400
Common services			25,000		40,000		73,000
Helicopter project					10,000		20,000
Total	691,200	678,900	250,000	679,000	650,000	718,800	900,000

[1] Regular seasonal force allotment.
[2] Special southern California forests allotment.

The following tabulation shows the fire control expenditures on the Angeles Forest by years for the last 11 years:

Year	Total number of fires	Total area burned	Cost of prevention and presuppression	Cost of fighting fires
1946	39	2,523	$239,909	$108,300
1947	44	3,824	250,763	187,222
1948	28	1,227	330,803	78,886
1949	50	16,311	328,702	266,316
1950	57	8,942	328,465	250,138
1951	53	7,996	312,312	105,476
1952	54	18	342,515	32,038
1953	73	72,906	347,641	2,154,662
1954	47	2,402	542,364	346,448
1955	36	1,714	617,421	271,409
1956	62	3,340	677,832	412,012
Total		121,203	4,318,727	4,212,907

These figures in no way reflect the tremendous loss incurred above the cost of control in flood damage, structures, water, recreation area and human suffering. This problem is further aggravated by military caused fires, especially aircraft.

Area of jurisdiction	Total fires	Acres burned	Cost to suppress	Other damages
Los Padres	23	3,687	$4,739.00	$44,563.00
Angeles	8	2,035	100,279.00	502,154.00
Cleveland [1]	10	11,889	214,828.00	62,703.00
San Bernardino	7	10,363	540,000.00	2,289,132.00
California Division of Forestry [3]	99	10,921½	80,791.00	53,857.25
Outside counties [2]	15	517	[4] 23.50	
Grand total	162	39,412½	940,660.50	2,952,409.25

[1] 1 California Division of Forestry man lost his life on a fire in the Cleveland National Forest.
[2] Outside counties include Ventura, Santa Barbara, and Los Angeles.
[3] California Division of Forestry jurisdiction includes San Diego, Orange, Riverside, San Bernardino, and San Luis Obispo Counties.
[4] Suppression costs and other damages not available from Los Angeles County.

NOTE.—Fires on Hunter Leggett Military Reservation not included.

The problem is receiving attention at this time and steps are being taken toward a solution.

The watershed fire council became aware of the inability of the Forest Service to fill positions and instituted a study of this problem. While this study is not completed we have already found that glaring differences of salaries, working conditions and opportunities exist in southern California between the Forest Service and other fire agencies. As an illustration:

FOUR BASIC FIRE-CONTROL POSITIONS

Comparing salaries of U. S. Forest Service, Los Angeles County forester and fire warden

Position, title, and U. S. Forest Service grade—Forest Service title compared with similar county positions	Annual salary (beginning of grade)	
	Forest service—5-day week with standby on 6th and 7th days as fire danger requires	Los Angeles County—Work and standby 62 hours per week, each day counting 24 hours, requires more than 2 men to fill each position
Fireman, GS–2	[1] $3,404	$5,004
Tank truck operator, GS–3	[2] 3,969	5,668
Crew foreman:		
GS–4	[2] 4,269	6,192
GS–5	[2] 4,587	
Fire-control assistant to ranger:		
GS–6	[2] 5,100	5,496
GS–7	[2] 5,656	6,060

[1] Includes 15 percent differential.
[2] Includes 25 percent differential.

The watershed council requests your consideration on these primary points:

1. Adequate appropriations to implement the 10-year plan.

2. A complete study of salary schedules, living conditions, hours worked, and benefits, for the Forest Service personnel.

3. An expanded and accelerated research program in the field of fire prevention and control, including:

(A) Heavy equipment: cats, 4-wheel-drive tracklaying tankers, transports.
(B) Fixed-wing and helicopter aircraft.
(C) Hazard reductions.
(D) Fire retardents.
(E) Small tools and equipment, fast couplings, light hose, etc.

The Federal Government assumed the stewardship of these lands just after the turn of the century, the full responsibility of this stewardship should be accepted and exercised. Give our men of the Forest Service adequate support, new equipment, adequate salaries, living and working conditions on a scale available to other services, access roads, full crews, quick response, aircraft, and other modern tools, and our staggering losses will be reduced.

The CHAIRMAN. Thank you very much, Mr. Carter. We appreciate your statement. You will be back tomorrow with your prepared statement, when we may have some questions that the committee will desire to ask.

Mr. HALEY. Mr. Chairman, prior to adjournment, I would like to ask unanimous consent that the picture of the dam on which I questioned one of the witnesses be made a part of the files of this hearing.

The CHAIRMAN. Without objection, it is so ordered. Without objection, the other picture submitted may also be made a part of the file.

(The pictures will be found in the committee file.)

The CHAIRMAN. Without objection, the statement, when filed, will be made a part of the record in the regular order.

The subcommittee will stand in recess until tomorrow morning at 9:30.

(Whereupon, at 5:30 p. m., the committee adjourned, to reconvene at 9:30 a. m., October 9, 1957.)

FOREST FIRE PREVENTION AND CONTROL

WEDNESDAY, OCTOBER 9, 1957

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Los Angeles, Calif.

The subcommittee met, pursuant to recess, at 9:30 a. m., in room 518, the Federal Building, Hon. Clair Engle, presiding.

The CHAIRMAN. The subcommittee will be in order.

We have something like 17 witnesses today, so we will have to limit the direct presentation to about 10 minutes apiece. It boils down to about 180 minutes, or 3 hours, of testimony, not allowing any time for any questions.

We will request those presenting their testimony who have prepared statements to undertake to summarize in 10 minutes, and then their prepared statement can be handed to the committee and in its complete form made a part of the record following the summary statement.

There is one group of witnesses here we will call first, and we will question them en banc, if the committee is agreeable. First is N. L. Clarine, superintendent of communication, Southern California Edison Co., Alhambra, Calif.

Do you have a prepared statement?

Mr. CLARINE. Yes, I do.

The CHAIRMAN. Off the record.

(Discussion off the record.)

The CHAIRMAN. You may proceed.

STATEMENT OF N. L. CLARINE, SUPERINTENDENT OF COMMUNICATION, SOUTHERN CALIFORNIA EDISON CO., ALHAMBRA, CALIF.

Mr. CLARINE. Gentlemen, my name is N. L. Clarine. My office address is 411 South Marengo Avenue, Alhambra, Calif. I am employed as a supervisor by the Southern California Edison Co. and have been in charge of fire-prevention activities for the company for the past 12 years, working in cooperation with all the fire-fighting agencies throughout central and southern California.

Within the areas we serve, I have under my supervision one employee who devotes full time to coordination and cooperative work with these agencies.

For 10 years prior to that time, at intervals, I was stationed in three of the national forests in central and southern California, and am familiar with the problems and activities of the various fire-fighting agencies.

The Southern California Edison Co., a privately owned utility, operates within the six national forests in central and southern California, starting with the Sierra National Forest in the north to the Cleveland National Forest on the south. Many large hydroelectric developments are located within these forests with distribution powerlines and electric service to many thousands of homes, playgrounds, and recreation areas, also to a considerable amount of industry, which includes sawmills and mining operations.

All of the high voltage transmission lines that carry the power to the San Joaquin Valley and the southern California area from the high Sierra Mountains and from Hoover Dam, pass through these national forests. Other utilities and municipalities also have transmission lines within these forests. Uncontrolled fires cause serious damage and interruptions of electrical service to users in these areas.

The Southern California Edison Co. has spent over one-half million dollars to install sensitive protection equipment on its lines in the fire areas to prevent arcing when a fault occurs. This protection equipment deenergizes the line in a fraction of a second, and the lines then stay deenergized until a visual inspection has been made.

Many thousands of dollars have been spent to clear annual and perennial growth around powerline structures, either by mechanical or chemical means or by soil sterilization. This greatly reduces the possibility of fires starting when damage occurs or contact is made with powerlines.

On our Big Creek hydroelectric project in the Sierra National Forest, the company owns a large amount of timberland of which a considerable amount has been burned over, thus destroying the timber and resulting in the growth of brush fields. These brush fields are being removed and trees are being planted, which are supplied by a nursery owned and operated by the company.

Foresters are employed by the company to carry out this work and also cooperate with the United States Forest Service in fire prevention and suppression work. The company has two fire pumper trucks to combat fires, and a fire boat operated on a large reservoir where roads are not available. These crews have detected and suppressed a large number of fires before damage could be done.

The company has over 500 cars and trucks equipped with two-way radios, and all cars that traverse the forest areas are so equipped. These cars report a great many fires and assist the fire-fighting agencies in the suppression of fires. All company personnel who work in forest areas are trained to observe sound fire-prevention practices.

The company is active in fire-prevention work and distributes many thousands of fire-prevention posters and literature. In addition, large displays are owned by the company and are displayed in their offices, at county fairs, and loaned to schools, clubs, and other civic organizations.

The company has a cooperative agreement with the Angeles National Forest to provide an additional patrol crew during the fire season. One-half of the cost of the operation of this crew and equipment is paid for by the company.

It is the opinion of the Southern California Edison Co. that the United States Forest Service has been highly efficient and cooperative in the protection of forest wild land, fire prevention, and suppression. We also believe that due to the year-round fire hazard in southern

California, a great deal more could be accomplished if more trained personnel and additional equipment were available on a year-round basis. In my personal opinion, to overcome the problem with which we are confronted, it will be necessary to have the cooperation of all the people, business, and industry in southern California. This cannot be a one-man job.

The CHAIRMAN. Thank you very much for that excellent statement, and if you will stay where you are, we will call the other witnesses.

Mr. Elmer L. Smith, representing the Pasadena Water Department. Do you have a statement?

Mr. SMITH. We have a short statement prepared this morning.

The CHAIRMAN. Will you give your full name, address, and state the capacity in which you appear before this committee?

STATEMENT OF ELMER L. SMITH, ASSISTANT CHIEF ENGINEER, WATER DEPARTMENT, PASADENA, CALIF.

Mr. SMITH. My name is Elmer L. Smith. I am assistant chief engineer of the water department of the city of Pasadena, 319 City Hall, Pasadena.

I have lived in Pasadena for over 50 years and worked for the water department for over 34 years.

In 1912 the water department acquired the major water companies serving Pasadena and adjoining areas, some of the adjoining areas, and ever since that time we have cooperated with the United States Forest Service in administering the watershed area which is immediately adjacent north of the city. This is in the Angeles National Forest.

We have contributed to the construction of a fire station in the mountains for a lookout. We pay a certain sum every year, have for a great many years, to the Forest Service for patrolling the area in order to prevent fires and for protection purposes.

We have our own patrolman who covers the area daily.

This area consists of the Arroyo Seco Canyon, the Millard Canyon, and the Eaton Canyon. The Arroyo Seco Canyon has 21.7 square miles, and Eaton has about 6½ square miles. We own about 800 acres in the Arroyo Seco Canyon in the name of the city, which was purchased for protection purposes for our water supply.

We obtain some 20 percent of our water supply from this so-called gravity water.

We have been very careful over a long period of years of having anything happen to this watershed area such as fire. Fires are very destructive to the water supply.

The Brown Mountain fire, for example, in 1933 covered the face of the mountain and, as a result, the flood of 1935 and subsequent years brought on a great deal of silt and ash and wood and other materials which had a deleterious effect on the supply.

One of the things which was the result of the fire was the deposition of areas of layers of the silt, very fine silt, and ash, which formed a sort of a gumbo which prevents the percolation of waters in, for example, the Devils Gate Reservoir, which is just below the mouth of the Arroyo Seco Canyon.

The easement for this reservoir area was conveyed by the city of Pasadena, the dam and reservoir were, to the Los Angeles County

Flood Control District. It has an original capacity of 46,000 acre-feet and has been about half filled up with this material caused by fires and subsequent floods.

The reason the city of Pasadena conveyed this land to the flood control district was to obtain a water supply through the percolation of the waters in the reservoir to the underground basin and the pumping out through wells.

These layers of materials that have been deposited have caused a great deal of diminution of the percolation.

In addition to this, the timbers and other materials brought down after the fire—a great deal of decomposition of these materials—caused the formation of carbonic acids which caused the formation of bicarbonates which make the water hard. They contributed to the formation of detritus in the main city in tunnels through which the water had to go, and, in fact, we had to abandon 2 or 3 wells.

We are very careful, as I said, of allowing anything to happen to the watershed.

For example, the Southern California Co. installed a coaxial cable in each canyon in one of our watersheds, and they wanted to remove all of the material for a wide strip of land underneath the cable on account of fire hazards. The United States Forest Service, the county forest service, and the city of Pasadena did not allow them to do this. We only allowed them to trim it so the height of the brush was not less than 20 inches above the ground so this brush would remain alive and retain its wood and hold back the erosion of material which would occur had it been completely denuded.

We have, in the formation of bridal trails on occasion—we have not allowed them to use automotive equipment to make trails. We made them construct them by hand in order to have as little loose material in the watershed as possible, because that would hurt our facilities and close them up with sand and other materials in the reservoirs and distribution system.

For a great many years the water department and some of the members of the water department, including myself, belonged to what was known as the Angeles Forest Protective Association, which was an association composed of cities and water companies and others interested in the protection of the forests and the foothills.

The question of burning, so-called light burning, to prevent fires has been discussed many times, and considered, and cast out as being a very bad thing for this particular area which we are interested in. The slopes are too precipitous, the soil cover is too shallow, and the consequent runoff increases flood damage and erosion due to any fires, whether they are manmade or otherwise, which is very detrimental.

Thank you for allowing me to talk.

(The letter submitted by Mr. Smith follows:)

CITY OF PASADENA,
Pasadena, Calif., October 9, 1957.

Re statement from the city of Pasadena Water Department to the Subcommittee of the Interior and Insular Affairs Committee, Congress of the United States of America.

Hon. CLAIR ENGLE,
Congressman, Chairman:

Shortly after the formation of the City of Pasadena Water Department in November 1912, cooperative action between the United States Forest Service and the city was started and has continued to this time. This cooperative work of watershed protection included sanitation problems and fire protection to protect

a portion of the water supply of the city of Pasadena derived from the Arroyo Seco Canyon.

In the early years of the department, the city purchased all privately owned lands consisting of 815 acres which were surrounded by United States Forest Service land. The Arroyo Seco Canyon is a narrow, winding, steep-walled canyon and we would shudder to contemplate any type of control burning in its drainage area since we have experienced water losses in the past due to forest fires, particularly the Brown Mountain fire of 1933, as a result of which, the runoff from the rainfall carried quantities of ash, wood, and eroded soils into the area at the mouth of the canyon behind the Los Angeles County Flood Control District's Devils Gate Dam. The result was the deposition of layers of sand, ash, and other detritus.

The result of this deposition was the sealing off of much of the water-bearing gravels, thus cutting down the percolation in the area behind the dam. The water which did percolate passed through layers of ash and debris, causing decomposition of these materials and the resultant degradation of the waters in the underground basin in the immediate area to such an extent that two good water wells had to be abandoned. In addition to this, a permit for 14 second-feet of water in the area has never been perfected because the water is still not of good enough quality for domestic use.

The department has a surface diversion right to 34 second-feet of water within the canyon and the Eaton Canyon, all of which lie northerly of Pasadena. The average water derived from the Arroyo Seco Canyon in the past 20 years, which has included a 12-year dry spell, represents 10 percent of the water production of this department over this period of time, and the total diversions from the 2 canyons has represented 17 percent of our production over the past 20 years.

We certainly would not like to have this gravity production jeopardized by any method of watershed protection not well proven to be safe in its use. We have had some experience in erosion control by the use of rye grass on relatively flat slopes and found that much depends upon the intensity of rainfall on the surface during its germination period. If the intensity is too great, considerable local erosion occurred, which we found had to be repaired and reseeded. It is difficult to contemplate in the steep mountains back of the San Gabriel Valley that the necessary attention could be given to grass seeding to gain the results desired.

Respectfully submitted.

DUNCAN A. BLACKBURN,
Chief Engineer and General Manager.

The CHAIRMAN. Thank you, Mr. Smith, very much for that statement. If you will remain up here, we will hear from Robert T. Radford, chairman of the Los Angeles County Watershed Commission, and then we can direct questions to anyone of the three of you.

You may proceed, Mr. Radford.

STATEMENT OF ROBERT T. RADFORD, CHAIRMAN, LOS ANGELES COUNTY WATERSHED COMMISSION, LOS ANGELES, CALIF.

Mr. RADFORD. Mr. Chairman and gentlemen, I am appearing before your committee at the invitation of your chairman, the Honorable Clair Engle, to discuss the Forest Service responsibilities for protection against forest and brush fires in southern California.

In order that I may establish some background for what follows, may I say that for over 30 years I have been vitally interested in the production, distribution, and conservation of water in the San Gabriel Valley of southern California. My activities have encompassed mutual water companies, water distribution committees, water protection and conservation associations, and during my 8 years as a councilman and mayor of the city of Monrovia the city's water production and distribution departments were under my supervision. At the present I am the president of the Upper San Gabriel Valley Water Association, which will shortly be in the process of forming a municipal

water district in the only area in the Los Angeles County coastal plain that is not now in the metropolitan water district.

In the protection of our brush-covered watersheds, little or no distinction can be made between the protection for private lands and the Federal forests. In this county, they are not separate watersheds, but are adjacent and contiguous. Inasmuch as there is no pattern as to when and where fires meet, it necessitates a dual responsibility to both agencies.

A fire starting on private land may invade the national forest, while a fire starting in the national forest may extend over into private land. These conditions have developed a close cooperation between the county and the Angeles National Forest.

In Los Angeles County, exclusive of the Malibu and the Santa Ana River drainage, this coastal plain requires an excess of 1,100,000 acre-feet of water per year. We are now importing approximately 316,000 acre-feet from the Owens Valley through the Los Angeles aqueduct, and approximately 154,000 acre-feet from the Colorado River. This means that we must produce approximately 630,000 acre-feet by pumping from the underground water. Estimating that the safe yield of underground water is somewhat less than 400,000 acre-feet, it leaves us with approximately 230,000 acre-feet overdraft per year.

The ever-increasing overdraft has now accumulated to more than 1,500,000 acre-feet.

I might say, gentlemen, that is a very conservative figure. The figure is probably closer to 2 million.

The central and west basins of this county find it will be necessary to form a replenishment district. It will cost the taxpayers of that area approximately $3 million per year to purchase imported water to be spread on the surface and through injection wells just to maintain the present underground water levels.

These statements shown above are given you for the purpose of bringing home to every member of the committee the seriousness of our watershed problem. The whole economy of this Los Angeles coastal plain is dependent upon its supply of water; 55.5 percent of all water consumed on this coastal plain is produced from the underground. Any interference with our water production seriously affects the economy of this area. Each time we burn over any portion of our watershed, we are increasing the cost of our economic production, while at the same time we are silting up our flood-control dams and debris basins. Our production costs are increased by our loss of native waters, and the importation of supplemental waters. The cost of flood control maintenance is increased and its efficiency is decreased by the silting process.

The Watershed-Fire Council of Southern California, appreciating the deficiencies that existed in the protection of the 4 national forests of southern California in 1954, requested the Forest Service to prepare plans and estimates of what was needed to do an acceptable job of fire control on the 4 forests. The plan was completed and, for our own Angeles Forest, the estimates showed increased annual appropriations for fire-control purposes in the amount of $710,000 were needed for a 10-year period.

It was broken down as follows: $515,000 per year was needed for operations and maintenance including housing and fire-fighting equipment; and $195,000 per year was needed for capital investment for such projects as roads, heliports, water tanks, firebreaks, surveys, and preplanning for fire suppression.

Let us look at the situation at the present time. The Angeles Forest has received $245,592 over the fiscal year budget of 1954. At that time it was stated that $710,000 annual increase was required to do an acceptable job of fire control. At this time, the Angeles has received only 34 percent of the 1954 estimated need.

Shown below are needs in 1954, accomplishments to date, and present requirements:

	1954, estimated need	Accomplishment to date	Still needed
Additional firemen	267	113	154
Fire-fighting equipment (pumpers, tractors, etc.)	28	8	20
Radio equipment	55	22	33
Prefire planning (ground surveys—constructing heliports and fire lanes)—acres	300,000	126,000	174,000
Water developments—units	57	1	56
Fire roads—miles	30	0	30

Now we show what we expected to buy with that money, what we have gotten to date, and what is still needed.

For additional firemen, the estimated need is 267, we have gotten 113 to date, and 154 are still needed.

On fire-fighting equipment—pumpers, tractors, and so forth—the needs are 28, we have 8, and 20 are still needed.

On radio equipment, the need is 55, we have 22, and 33 are still needed.

On prefire planning—ground surveys, constructing heliports and fire lanes—the need is 300,000 acres, we have 126,000 acres, and 174,000 acres are still needed.

On water developments, the need is 57 units, we have 1 unit, and 56 units are needed yet.

On fire roads, 30 miles is the need, we do not have any, and so 30 miles is needed.

The responsibilities of the Forest Service are very definite and extremely important to this county. It is my considered judgment that the Forest Service is doing an outstanding job with the men and facilities they possess. First, let us recognize that our fire season is 12 months long. Second, let us admit that in this labor market, the Forest Service cannot compete with business and industry for men. In my own city of Monrovia, one-third of our fire department is Forest Service trained. The Forest Service loses trained men each year to cities, counties, and to the State because of part-time employment programs and insufficient pay.

The Congress must understand that proper housing and adequate pay for their employees in the Forest Service in southern California are essential to top accomplishment. If the Congress will only recognize our problems, and then meet them with the proper financial assistance, the men of the Forest Service will more than fulfill their responsibilities.

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Thank you.

The CHAIRMAN. Thank you very much for your statement, Mr. Radford.

For our further edification, the Los Angeles County Watershed Commission, I understand, is an official agency established by the board of supervisors; is that right?

Mr. RADFORD. Yes, by ordinance.

The CHAIRMAN. Established by ordinance?

Mr. RADFORD. By ordinance No. 6393, if I am not mistaken.

The CHAIRMAN. And the responsibility of that Commission is to work directly on the planning and the control of the Los Angeles Watershed?

Mr. RADFORD. That is right; and anything that might tend, Mr. Chairman, to benefit the watershed control in safeguarding it. It is ordinance No. 6393, passed March 26, 1954.

The CHAIRMAN. This plan that was set up by the Forest Service and referred to in your statement, so far as you are aware, did that plan ever secure the approval of the higher echelons in the Forest Service?

Mr. RADFORD. Oh, yes, sir; yes. In other words, in the regional area here, yes, and I am sure back in Washington, because we have talked with them back there.

The CHAIRMAN. You mean they thought it was a fine thing if Congress would do it?

Mr. RADFORD. Yes.

The CHAIRMAN. I noticed on the part that ought to be done the least has been done.

Mr. RHODES. Will the chairman yield?

The CHAIRMAN. Yes; I yield.

Mr. RHODES. Do you know whether the Forest Service ever asked the Bureau of the Budget to put these items in the annual budget?

Mr. RADFORD. I will tell you, sir, I have been back to Washington several times in trying to boost the ante a little on this thing, and I am of the opinion that it is in all right.

But the question in my mind—and I might say this very frankly to you, gentlemen—in what position of priority is it? Because, after all, you men know what I am talking about. If it is in, I have never been able to find out yet what rank of priority it is in. I am sure it is back there. I am sure they have it. I know, having been back and talked with the men in the Forest Service back there, that they are all of them hoping. I am talking about Dr. McArdle. We had him out here and showed him some of these things recently, and we had Mr. True Morse here and showed him. In fact, we had him fly over the San Gabriel fire, which just occurred here a few weeks ago.

Does that answer your question?

Mr. RHODES. The point is that we have a hard time appropriating money unless somebody asks us for it; and it is pretty easy for a department to say, "This is fine and this is what we would like to have." But if it never gets translated into a budget request, or at least a request during the hearing before the Appropriations Committee, then the best intentions have gone for naught.

Mr. RADFORD. I know that, but it is a little difficult for outsiders to find out just what is going on.

Mr. RHODES. I realize the question could be better directed to somebody else, but you brought up the point, so I thought I would see if you knew.

Mr. RADFORD. That is all right.

The CHAIRMAN. You cannot definitely say whether or not the Bureau of the Budget has ever included any of those items?

Mr. RADFORD. Yes, sir, they have, because we have in the Angeles here—I am talking about the Angeles because I am closer to it—we have received $245,000 more than we did receive in 1954. So that they have given us part of the request each year except this last fiscal year.

Does that answer your question, Mr. Chairman?

The CHAIRMAN. Not exactly, because I am not so sure it has ever been included as an earmarked item. The trouble is that somehow or other it gets lost in the shuffle, and I have a feeling that neither the Bureau of the Budget nor the Appropriations Committee have ever been made to understand the special problems of fire control in southern California, and the Forest Service, as a whole, is not set up to manage this type of problem.

Mr. RADFORD. May I say this? I have not had the opportunity nor the privilege to appear before the Subcommittee on Appropriations of which Mr. Kirwan is chairman, but I have appeared before the Senate subcommittee, and the Senate subcommittee knows that this has been requested right straight along. That is the only place, gentlemen—it was through the Senate Subcommittee on Appropriations that we did get the increase. They put it in on their side and the House accepted a portion of it. How much they put in I cannot tell you.

The CHAIRMAN. Mr. Clarine, I notice that your cars are equipped with two-way radios. Do they operate on the same frequency as the Forest Service?

Mr. CLARINE. No; they are on a separate frequency.

The CHAIRMAN. How do you maintain communication with them?

Mr. CLARINE. We have a direct line between our Forest Service headquarters and wire lines. We radio into our station and it is passed right to the Forest Service.

The CHAIRMAN. In other words, if one of your fellows out in the area spots a fire you can communicate rather quickly?

Mr. CLARINE. That is right.

The CHAIRMAN. But it has to be back through your own headquarters?

Mr. CLARINE. Through our dispatchers to their dispatchers, yes.

The CHAIRMAN. We are all pleased, I think, with the excellent cooperation the Forest Service gets in this area, not only from all other Government agencies but from the utilities.

The gentleman from California, Mr. Sisk.

Mr. SISK. Mr. Chairman, I want to commend Mr. Clarine on the job that his company is doing. He mentioned the Big Creek area, which happens to be in my district, and I know something of the work they are doing up there, and it is certainly an outstanding job.

I know particularly the reforestation in some of those areas which you mentioned, and I want to commend Southern California Edison for the work they are doing in that particular area up there and

for the cooperation that I understand the Forest Service has received there.

I want to commend the very fine cooperation of the California Edison people.

In connection with the statement of Mr. Radford, I have worked with the committee some with reference to Forest Service funds, Mr. Radford, and I am very definitely of the opinion that if you ever get the budget to request your money you will get your money. I think it is just that simple.

After all, we have a lot of problems back there, and if you cannot sell your program to the extent that you can get the budget to put it in their request, you are going to have a rough time ever getting very much money. I think that is something you are going to have to keep in mind.

I agree with you that there is no question but what we need additional funds all up and down the State immediately. In my area we need additional equipment. But the Forest Service is doing an outstanding job, although there is not any question they need help in the salary angle, and so forth.

I have one question. You make this statement, on page 2, Mr. Radford:

> Each time we burn over any portion of our watershed, we are increasing the cost of our economic production, while at the same time we are silting up our flood-control dams and debris basins.

You are referring there to water production?

Mr. RADFORD. No; I am not. I am talking about all production in southern California. In other words, it is necessary to have water, and every time we lose our native water we increase the cost of the water to the consumer.

Mr. SISK. The point I was getting at, though, Mr. Radford—I do not know whether you were here yesterday afternoon or not.

Mr. RADFORD. No.

Mr. SISK. We had a discussion then with reference to control burns on less steep areas to destroy and get rid of some of this brush which is always a fire hazard. I think some of these people, in checking, have found some of this brush is pumping a lot more water out of the ground than you would lose by getting rid of it. That is what I had in mind.

Mr. RADFORD. May I make a comment on that, if I can?

Mr. SISK. Yes.

Mr. RADFORD. I think all of you men are very familiar, of course, with the type of topography of our ground here and our mountains. So it is almost impossible. You cannot burn off because you get into the silting process.

We have just gone through a fire of about 2,500 acres in the San Gabriel Canyon, and it is estimated we are going to have at least 400,000 cubic yards of dirt either in the No. 1 dam or in the Morris Reservoir up there as a result of this fire. That is a tremendous economic loss. You lose not only the capacity of your dam—and if you want to keep that capacity, it is going to cost—I do not know—five or six dollars a cubic yard to get it out. And then you have to find a place to put it.

So I know this: That all through southern California—and I have been there a long time—the cost of water is continually rising, and the cost of water will continue to rise with imported water.

Mr. SISK. I appreciate what you are saying, Mr. Radford, on your steep areas, very rugged steep mountains. I actually had in mind, of course, on some of these other areas, on the benches, and so forth. I am of the opinion—at least many of these experts have testified in some cases the brush is pumping more water out of the ground than if you destroyed it. I know what happens when the silt and dirt comes down. That is all.

Mr. RADFORD. Let me come back to another question. I have had personal contacts with Mr. Robert Merriam, of the Bureau of the Budget, for a couple of years. The fact of the matter is just this last week I wrote him a long letter, which is probably just about as long as this statement here, concerning what our present problem is.

For your information, I did include in that letter the compilation on the top of page 3 for his perusal.

I do not know if you men of the Congress can tell us how we laymen can get the Forest Service men who prepare the budget to shoehorn this in. We would be very grateful to you indeed if you could.

The CHAIRMAN. The gentleman from Arizona, Mr. Rhodes.

Mr. RHODES. Mr. Radford, on page 2 here, the second paragraph, you say:

> It will cost the taxpayers of that area approximately $3 million per year to purchase imported water to be spread on the surface and through injection wells.

I assume this means you are going to import some more water from somewhere. Where are you going to get it?

Mr. RADFORD. There is only one place we can get it from, and that is from the Colorado River at the present time. There is no use being cagey about anything. Those are the facts. I know that you are from Arizona, but nevertheless that is the answer to it.

Mr. RHODES. Of course, we feel fairly friendly toward our friends in California in spite of the fact that stream does run between the two States and there is some argument about it.

I was amazed to see, though—is this figure correct?—that approximately 154,000 acre-feet is imported from the Colorado River at this time.

Mr. RADFORD. That is right.

Mr. RHODES. Is that for all of Los Angeles County?

Mr. RADFORD. Yes, sir. That is from a report I got from Robert Deamer, chief engineer and general manager——

Mr. RHODES. Does that include the San Diego diversion?

Mr. RADFORD. No; not that amount. That is simply in this county.

Mr. RHODES. I see.

Mr. RADFORD. I might explain this $3 million, if I may.

They have got a lot of salt water that has come in all along the coast, all the way from Santa Monica down to the Orange County line, and in order to keep that out they are in the process of forming this area, which is that area in Los Angeles County in the San Gabriel Valley which is below the Millard Narrows and goes over and takes in all those beach towns also. These figures which I have were given me by Mr. Libberty of the flood-control district. In this replacement

district they are attempting to establish—at the present time there is an assessed valuation—the last figure was $1,980 million, which is probably past the $2 billion mark now. Now the importation of water at $15 an acre-foot and the ad valorem tax upon that assessed valuation will make your $3 million. So they propose to put on an $8 an acre-foot pumping charge to everybody that pumps in that area at all, pumps water from the underground. They will have to pay $8 an acre-foot into this fund plus a 5-cent ad valorem tax, which will make $3 million. And that will not raise the water level; all it will do is hold it where it is at the present time.

Mr. RHODES. Mr. Chairman, apparently I have been under a little bit of a misconception as to the objectives of watershed control here. I did not realize that so much of the object was to get water into the underground. It is obvious that the handling of this slope is a different problem than handling most other slopes in the United States.

Over in my particular area, the Salt River Valley watershed, we are trying to get the water to run off. All during these hearings I have been trying to get you people to allow the water to run off, too.

Mr. RADFORD. We do not want it to.

Mr. RHODES. I can see now with your silt problem, and everything else that goes with it, the best thing you can do is to get that water to run into the underground with the least amount of transpiration loss which is possible.

Mr. RADFORD. I can say this: It is the objective of the fire control district in Los Angeles County that not a drop of water that comes down will ever get into the ocean. Even with some of the type of storms that we have here, it has been years since more than 7 percent of the amount of water that has fallen in this area has gotten to the ocean, because we want to put it in the underground. And there are lots of areas in which our water table is a hundred feet lower than it was 10 years ago.

Mr. RHODES. So is ours, and I just hope there is enough water in the Colorado River to raise both of our water tables.

Mr. RADFORD. Well, we want to safeguard it. We do not want the boys at the upper end to take too much away from us—Arizona and California.

The CHAIRMAN. Thank you very much for your statement, Mr. Radford. We appreciate your appearance before the committee.

We also thank Mr. Clarine and Mr. Smith.

The next group of witnesses are connected in one way or another with the lumber industry. We have Mr. W. R. Schofield, secretary-manager of the California Forest Protective Association, San Francisco, Calif.

We will be glad to hear your statement, Mr. Schofield.

STATEMENT OF W. R. SCHOFIELD, SECRETARY-MANAGER, CALIFORNIA FOREST PROTECTIVE ASSOCIATION, SAN FRANCISCO, CALIF.

Mr. SCHOFIELD. Thank you, Mr. Chairman.

I think perhaps I can shorten it a little bit by just referring to some of the highlights as I go through the prepared statement.

However, prior to making my prepared statement for the record, I might say I am a professional consulting forester, a registered civil

engineer in the State of California, and I am employed as the secretary-manager of the California Forest Protective Association, which is a group of private timber owners in the State of California owning approximately 90 percent of the private timbered area of the State.

I first want to make a brief reference to some of the statements that were made yesterday by witnesses which I trust the committee has perhaps taken with some consideration.

I want to say, particularly with reference to the statement made by Dr. Biswell relative to his program of forestry and management, as a practical forester and, I believe, speaking for those who are vitally and directly concerned with forestry in California, we cannot concur with much of the statement that Dr. Biswell made yesterday. You will find just as many, if not more, in controversy as to his methods of control burning and brush clearing and so forth.

I also want to point out—and I think you gentlemen understand—the statement made by the attorney from Santa Barbara County relative to Congress passing some measure which would eliminate the liability for negligence of an individual who might touch off a fire that would cause property damage, that I think you gentlemen are fully aware at the present time there is not any way in the world a law could be passed that would guarantee a man absolvence from liability in a case of negligence.

I am not an attorney, but I know as far as the State agencies are concerned there is definitely a liability of negligence of a State employee, and I think it would be correspondingly so relative to Federal employees.

Gentlemen, this matter of fire protection, particularly in California—I am speaking more generally of the entire State rather than southern California, although I specifically refer to certain matters in southern California. I do not wish to set myself up as an absolute authority on all of the various phases involved, and I do not wish to be considered as critical of the handling of fire protection, particularly the Federal Forest Service, except as I can be objectively critical and perhaps present some constructive suggestions.

As a forester representing private timber ownership, and having served in the capacity as a forester for governmental ownership, I find that the observations I might make perhaps should be helpful because of the fact that we are not the administering agency that may be handling such a matter. And sometimes you get a broader view and can observe from the background those things which may be perhaps shortcomings.

We have a condition here in the State of California which is extremely hazardous during certain periods of the year relative to fire. We have, we think, a very capable and efficient fire-fighting group in our division of forestry, and it has been, the development, through the backing of the association which I represent that this has been created.

There are shortcomings in the division of forestry; there are shortcomings in the Federal Forest Service so far as the management and handling of certain fire and fire techniques. We feel that perhaps the exchange of experiences between these two agencies might well help. There may be some professional jealousies and pride which sometimes enter into the situation which do not help in this problem.

The Forest Service—I am speaking specifically now of what I am just talking about—the Forest Service has certain practices of attack of fire from a fire line, which is my understanding as a State policy is absolutely prohibited because of the danger to the crew. This is an instance where the differences of approach in handling the protection problem might well be developed by an exchange of ideas.

The CHAIRMAN. I would be interested if you would document that statement. We have not said much about those 11 fellows who were killed out here in the fire, but I will be frank to say that when 11 people get killed in a fire usually somebody is hauled in before a grand jury to find out why it happened. I have never been satisfied there was proper cognizance taken of that kind of loss of life, and somebody ought to be responsible for it.

If you can document the statement, Mr. Schofield, that the Forest Service actually and deliberately uses policies which endanger crews and which would be prohibited under State firefighting practices, we would certainly be interested in having it in the record. (See p. 265).

Mr. SCHOFIELD. Mr. Chairman, I would be very happy to give you the information that I have and try to present it to the committee at a later time, that which will support the statement I have made, I believe. And I think it is the belief of other professional foresters that that is a policy. I do not know it is a policy; it is happening and it has occurred before. I think it is due to the lack of knowledge of how to fight fires. That is the primary function. It is not because it is the policy of the Forest Service, it is because of the inadequacy of education of how to fight fires under varied conditions, and I shall be happy to present to the committee that comparison.

I want to also point out the fact that in my estimation and, I think the estimation of others, that perhaps the failure of these agencies—and I am not absolving our division of forestry in this—the failure of them in taking advantage of certain techniques which have been developed, which are new tools and new approaches to firefighting, which is, I think, unfortunate, because I believe that they have certain advantages and certain possibilities that should be used.

I refer specifically to the matter of area ignition. I think you will hear more about that from men who have conducted area ignition, and which has proven itself to be effective and which will correct the situation in many instances.

I also want to refer to the fact that there has been definitely demonstrations of cloud dispersal and lightning dispersal by airplane, while the Federal Government has for years up until a few months ago concentrated upon cloud dispersal from ground generators rather than from aerial contact. This year, fortunately, we have had a very good demonstration by the State, and the Federal Forest Service has been participating, I know, in which cloud dispersal has been done from the air.

Mr. RHODES. If I may interrupt, this is the same as cloud seeding, is it not, this making it rain?

Mr. SCHOFIELD. That is right. It all comes together.

In directing lightning from cloud to cloud instead of cloud to ground, and the precipitation causes the wetting down of an area. But principally the field of dispersal of the lightning that will actually strike so it will not strike, will not go from cloud to ground, which has

been demonstrated, and the State of California has a record of that demonstration performed by an individual. You got to be crazy to do it, but he did it.

Mr. RHODES. How did he do it?

Mr. SCHOFIELD. He flew right into the clouds. Anybody who would fly into a storm cloud like he did is crazy. There is no question about it. Nobody who has done any flying would fly into an electrical cloud, but he did it and proved to the satisfaction of the State division of forestry of California that lightning was transferred from ground to cloud to cloud to cloud. It has not been used. It is an expensive deal, sure. But, after all, the dollars that are spent in control of fire is certainly much more than what that would be.

That, again, is a question of appropriations, and I do not blame the Division for not going in, but I say there has been too much concentration on the first idea, that they were going to disperse the clouds from ground generators. It is not as effective as from the area, and they have proven that this year.

The suppression activities of these various agencies are based upon a knowledge of the area in which a fire is being taken care of. I have, for a number of years, observed a very rapid turnover or rapid transferring of individuals from one area to another, to the point that men who are in charge of large areas of national-forest lands as rangers are unfamiliar with the district in which they are supposed to be able to handle the fire situation. They do not know the people; they do not know the area; they do not know the weather conditions. I think that is unfortunate.

My understanding is that the reason for this is because it is a question of promotion. If it is a question of promotion, in my mind, it should be a question the Congress could very well answer by seeing to it there were available funds whereby a ranger could be maintained for a number of years in a range district and promoted from a financial standpoint by a broader spread of salary increases.

I recall in my early days in the Forest Service of rangers who were started out and had been for years and years in a district, and they could walk out blindfolded over every foot of their district. Rangers cannot do that today.

Furthermore, many of them are not too familiar with the techniques of fire fighting, and ofttimes we have industry employees who are taken on the fireline who know a hundred times more than the man who is in direction.

I would think it would be very good policy for a woods boss who knows the area in which he is going to fight a fire to be given some direct control of the personnel or crew which is fighting in that district. I doubt very much if that would relinquish very much. I think it would be a good idea.

I have listed a number of suggestions on the sixth page of this report, in which I state some have been followed and some have not.

I think an analysis of specific fires, with a view toward attempting to find new methods of approach in attack, would be a helpful thing.

I think the creation of local community groups to analyze and get support for suggested new methods rather than a continuation of always looking to the Forest Service for the answer and seeking only some more money would be a good idea.

I suggest also a stepped-up-policy type of control to reduce carelessness and curtail incendiarism, which has been effective in other areas.

I suggest imposition of heavier penalties for incendiarism and upon violators of forest-fire laws.

I suggest forestwide closures under extreme weather conditions. You are aware of the fact there have been some closures in California, but not as much as there should be. We have the same concept of trying to control closures in our State setup.

We have a law in the State of California that it can be closed, but political wisdom does not close when they should close. They do in the State of Oregon, but they do not here. We have never had that. But national forests ofttimes, because of the group of recreationists who are in it and are going to use it, are withheld from closures when I think they should be closed under extreme fire-hazard conditions.

Next I suggest a more extensive use of aerial tankers, helicopters, and chemical sprays in the initial attack. I might say this year has seen a very stepped-up effort on the part of both the State and Federal Government in this, and it is proving successful.

Increase accessibility by the construction of new roads, and those new roads are for fire purposes only and should not be made available or used by recreationists, which would create a greater fire hazard.

I suggest experimentation in establishment of new types of ground cover which will protect the watershed and at the same time reduce the fuel and fire hazard. This is to be particularly emphasized on watershed areas in southern California and the brush fields of northern California, and perhaps it might be something along the line which has been experimented with to some degree of success by the herbage experimentation conducted in some of the Southern States.

Thank you.

The CHAIRMAN. Thank you, Mr. Schofield.

(Mr. Schofield's prepared statement follows:)

STATEMENT, FIRE PROTECTION PROBLEMS IN CALIFORNIA

On account of the large area and diversified vegetative cover and climatic conditions, the State of California presents a complicated fire-protection problem. The national-forest areas in California share, in common with the areas of protection responsibility of the State of California, similar conditions and in many instances of equal hazards.

To those of us who have been conversant with the problems of both the Federal Government and the State, and particularly those of us who are not directly connected with the administrative agencies of either the Federal Government or the State, there appears to be much which might be considered as constructive criticism of the handling of fire-protection problems. I do not wish to set myself up as an authority on all of the various phases involved, nor do I wish to be considered as critical of the handling of fire protection excepting insofar as I can be objectively critical and, perhaps, to present constructive views as to how the problems may be best approached and solved.

As a forester, and one who has had past experience in fire-protection work, both from a governmental and a private timber-ownership standpoint, it would seem to me that it is a healthy situation when those from the outside can present observations which may in part be accepted to perfect the present operations of the fire-protection agencies. As a representative of approximately 90 percent of the private timber ownership in the State of California and of a considerable acreage which, due to its location, becomes the object of protection by the United States Forest Service, I believe I can express some of the association members' views as to the adequacy of the protection furnished by the

national forests under a cooperative agreement with the State of California. It is conceded that the amount of contractual payments made by the State of California to the United States Forest Service does not attain the figure of the estimated national-forest costs on an average basis. It has, however, been the contention of the private timber ownership, coming under this contractual protection, that, if the Federal agency accepts the contractual agreement to furnish equivalent protection to the private timberlands in their protection area, once accepted with the stipulated reimbursement, equal protection should be given. Unfortunately, this has not been the condition in the past which has been admitted by the Forest Service. Continued emphasis of this fact finally has brought about a revision of the contractual arrangements by the State with the United States Forest Service, with specific locations for protective forces and equipment in accordance with the State's plan of protection. It was believed that this would solve the question of equal protection. However, an evaluation of this season's operation just closed has not been made which might indicate whether this has been accomplished.

As would be natural between two organizations conducting a fire-protection program, under different policies and different technical application of protection measures, the State of California Division of Forestry in its operations does not approach the same problems in the same manner as does the United States Forest Service. Pride of management and operations will perhaps always keep these two agencies away from complete agreement in methods and procedures. However, as an observer from the outside, it appears to me that sometimes professional jealousies and pride should be secondary to better practices which may be evolved by another agency, and I believe that both agencies would do a better job with a more free exchange of ideas and patterns of operation and applying them in their own problem solutions. There is a difference in the policies of brush-fire-fighting methods as conducted by the State division of forestry and the United States Forest Service. The Forest Service have certain practices of attack from a fireline which the State policy absolutely prohibits because of danger to its crews. This is an instance where difference of approach in handling a protection problem might well be developed by an exchange of ideas into a more safe and practicable method.

There has been a stepped-up program of forest-fire research in the State of California, both by the United States Forest Service and the State of California. However, there is probably much which is proven in the way of good fire-protection techniques that have not been adopted and used by the protective agencies, or at least not to the extent that should be.

Specifically, let me refer to the question of area ignition, which has been demonstrated to be one of the most effective procedures in fire suppression as well as fireproofing protection, yet it seems to have been bypassed and ignored and has not become a standard method. Another example is the use, to a greater degree, the technique of cloud dispersal from the air rather than the use of the yet unperfected cloud dispersal or weather modification through the use of ground generators.

In more recent years, the United States Forest Service has had a very large location changing of field personnel. This has been to such an extent that there are local districts of the Forest Service which are administered by personnel unfamiliar with the area, its physical and climatic conditions and its fire characteristics as well as being strangers to the citizens residing in the area. This all tends to reduce the efficiency of a fire-protection program. The excuse for such transfers has been that the personnel is deserving of promotion and in order to give such deserved promotion (which is primarily a salary increase) these transfers are carried out. It would appear to me that a thoroughly informed field personnel should be retained in these local areas for much longer periods of time and that provisions should be made whereby adequate promotional compensation could be given without having to transfer the individual. This, however, could only be handled through granting a more flexible promotional compensation program in the Forest Service.

There appears also to be in the conducting of fire suppression activities, that too often those who are given authority for the direction of suppression have a limited familarity with the procedures which they are supposed to be directing. Quite often, one will find, in a fire crew a woodsman or a local resident much more capable of handling a situation in a directing capacity than the forest officer who may be assigned. This ability might well be utilized by putting such an individual in a supervisory capacity in a crew to perform certain tasks and reserve the manner of the performance of such a task to judgment and experience of that individual.

I would suggest also that at the conclusion of any fire season that the usual fire review take on a more critical and analytical approach than is done at the present time. Such reviews have many times been resolved into merely a restatement of the cause and the manner in which the situation was handled without any true analysis of what might have been a better method.

There seems to be a constant pressure upon Congress for more and larger appropriations for fire suppression to be handled by the United States Forest Service. Some observers have commented that even though the larger appropriations were to be given that the expenditures would be in the same direction and in the same manner as the money is now allocated. Little attention is being given to the utilization of present appropriations to a greater efficiency through the adoption of proven methods of fire prevention and suppression which have as yet not been incorporated in the fire protection plans.

In southern California particularly, there is a constant cry from all concerned locally to step up and increase the initial attack. This may be honestly questioned when on review we find that 95 percent of the fires which occur are controlled by the present crews. The present initial attack is good and increasing the number of men or the equipment would do little better. These fires become big and dangerous on account of fuel, steep ground, and abnormal wind and weather conditions. I have heard it expressed by some that the present methods of fire fighting are beyond the point of diminishing returns in southern California, but do not apply to the timbered areas of northern California.

Some suggestions that might well deserve further consideration are herewith submitted.

1. Analysis of specific fires with a view to attempting to find now methods of approach in attack.
2. The creation of local community groups to analyze and get support for suggested new methods rather than a continuation of always looking to the Forest Service for the answer and seeking only more money.
3. A stepped-up policy type of control to reduce carelessness and curtail incendiarism. (This has been effective in some areas.)
4. Imposition of heavier penalties for incendiarism and upon violators of forest-fire laws.
5. Forestwide closures under extreme weather conditions.
6. A more extensive use of aerial tankers, helicopters, and chemical sprays in the initial attack (this suggestion has been given much impetus during the 1957 season).
7. Increase accessibility by constructing more roads (for fire purposes only).
8. Experimentation in establishment of new types of ground cover which will protect a watershed and at the same time reduce the fuel and fire hazard. This to be particularly emphasized on watershed areas in southern California and brush fields of northern California. (Perhaps something along the lines of herbage experimentation as has been carried on in some of the Southern States.)

The CHAIRMAN. Mr. David H. Rogers, Post Office Box 769, Redlands, Calif., manager of the Big Bear Timber Co. Is that right?

Mr. ROGERS. That is correct, sir.

The CHAIRMAN. Do you have a prepared statement?

Mr. ROGERS. I do. I am sorry I follow right behind Bill Schofield because we go more or less along the same line.

The CHAIRMAN. Can you summarize your statement?

Mr. ROGERS. I believe my statement is brief, and I can do better by reading it.

The CHAIRMAN. You may proceed.

STATEMENT OF DAVID H. ROGERS, BIG BEAR TIMBER CO., REDLANDS, CALIF.

Mr. ROGERS. Mr. Chairman and gentlemen, wildfires and fire fighting in southern California present some of the most difficult problems of any areas in the United States where fires occur. To meet this challenge, Federal, State, county, and private agencies have spent thousands of dollars each year.

Some of the specific problems to be faced are first the length of the fire season. In most areas the normal season lasts approximately 6 months while in this area extreme burning conditions are encountered 9 to 10 months of the year. Second, during this long fire season with its arid conditions some of the most extreme fire danger weather conditions in the Nation occur with zero humidities, zero fuel moisture, and Santana winds up to 50 miles per hour. A third condition which exists is the high incidence of fire occurrence because of the nearness of the metropolitan areas which extend to the forest boundariess and produce heavy use of the forests.

In southern California, fire fighters are faced with two types of forest cover which present differing burning conditions and require entirely different fire fighting techniques.

The chaparral cover is characterized by steep topography, dense cover, and is very inaccessible, rate of spread of fire is very rapid. This type covers most of the wild lands in southern California and produces the most extreme fire problems and fires.

The forested or timber types cover a smaller portion of the area, usually at the higher altitudes and are used by millions of people each year. This tremendous use creates a problem of safety for the people from fire and although the burning conditions are not as severe as the chaparral areas, under certain conditions a holocaust can develop. These forests are overmature and decadent with large volumes of dead and dying material being present thereby creating a tremendous fire problem.

These are the problems which must be recognized and overcome to control wildfires in southern California.

Now let's look at the past fire history in the area. For instance, taking the Angeles National Forest as an example: From 1900 to 1919 practically the entire forest was burned over. Bad fire years occurred again in 1924, 1935, 1945, and 1956 with large areas reburning. Studies made in 1940 revealed that large fires begin to recur after approximately 12 years following the original burn in the chaparral types. A good example of this are the recent burns along the front country of the San Bernardino National Forest. In other words, history seems to be repeating itself every 10 to 15 years with disastrous fires burning the same areas.

What has taken place during this period? Protection has been increased year after year. Roads have been extended. Firebreaks have been developed. Fire crews have been added at strategic places and enlarged. Large numbers of fire trucks and tankers have been added, fire-fighting techniques have been changed and improved. Much money has been spent, but we are still getting large burns.

Has the past approach been satisfactory? I think that it can safely be said that it has under normal conditions, under scant vegetation conditions, and inaccessible areas.

Where the problems seem to arise are those fires that start under abnormal conditions where men and equipment are on the fire at the start and cannot hold it. After burning into the second burning period in the rugged terrain it takes a change in weather before it is controlled. It is true that efforts applied by the manpower and equipment have had their effects, but the burned area still remains large. The existing agencies should be given credit, because without

present organizations, due to the great buildup in the protection problems, the loss would be much greater.

What are the answers? I believe that an entire new approach is necessary and recent developments in fire-fighting techniques seem to bear this out. Something must be done to stop these critical fires.

In the forested areas, which are critical areas for protection of life and property, a program of cleaning up the forest and making the areas accessible for movement of equipment and fire crews is a must. These areas are not only subject to fires within the areas proper, but are susceptible to fires sweeping in on broad fronts from the lower chaparral slopes. I think every forester in southern California shudders when he thinks of what might happen in these areas under certain conditions.

Having been interested in fire fighting for many years, not only in southern California but also over the entire State, I have taken the opportunity to follow the fire-fighting strategy and technique on various fires here in southern California the past 4 years.

The various agencies responsible for initial attack and suppression seem well coordinated and cooperation is good. If it does break down it is due to overhead lacking in experience of the local situations and conditions. Fire fighting and fire behavior in the brush and timber types are entirely different, both can be explosive, and lack of knowledge can bring disastrous results.

There has been continued research on fire behavior through the years. Probably the most important in this area was the recent cooperative experiment, Operation Fire Stop, which had its merits, especially in the development of helicopter use and chemical retardants, but fell far from obtaining conclusive results and complete answers.

In conclusion, I would like to put these points before the committee as possibly a better solution to solving those critical situations where fires are still getting away year after year in spite of the money being spent.

1. There is need for more money for prevention to develop proven techniques which in turn will lower suppression costs.
2. I criticize all agencies for their slowness in developing an air arm.
3. Initial ground attack must be supplemented by air attack.
4. There must be a continued air attack during the fire.
5. There must be continued development of helicopters for movement of manpower, hose laying, et cetera.
6. The training of Overhead is very important and should be maintained at a high level.
7. Cooperation must be maintained between agencies at the highest level.
8. A sanitation logging program must be established in all the timbered areas. A program of this sort serves a dual purpose. Good forest management is practiced, recreation is benefited, fire hazards are reduced, accessibility is obtained for fire fighting, and a return is made to the public through stumpage.

Thank you.

The CHAIRMAN. Thank you very much, Mr. Rogers.

The next witness is Waller H. Reed, chief forester for the Collins Pine Co., Chester, Calif. We are glad to have you here, Mr. Reed.

STATEMENT OF WALLER H. REED, CHIEF FORESTER, COLLINS ALMANOR FOREST, COLLINS PINE CO., CHESTER, PLUMAS COUNTY, CALIF.

Mr. REED. Chairman Engle and members of the committee, you have been hearing most of the time from southern Californians. Being a resident of Congressman Engle's district, he undoubtedly realizes that some of my comments will be from the northern California standpoint.

I also understand yesterday everybody here was an expert, and I want to point out I am not an expert.

I would like to point out off the cuff here that we seem to have an opinion in this country that all of our problems are solved if we just get enough dollars; whether it comes from congressional appropriations or State appropriations, we could solve all of our problems if we had enough money. I suppose we could stop every fire that ever started in California if we had a fire crew behind every tree or out behind every brush patch, but that is certainly impracticable.

It is my opinion that we can very much better spend some of the dollars we are now spending for fire protection—forest protection, I like to call it, because we are not protecting fire—and get at least part of this job done.

I have spent 17 years in Tehama County, Calif., managing about 90,000 acres of a private tree farm. We call it a tree farm, growing trees. We are in the tree-growing business just like the farmers grow oranges down here.

Those lands are intermingled with and adjacent to national forest lands, and I have had the opportunity over those 17 years to observe the practices of the Forest Service in all forms of forest management, including protection.

I am a graduate professional forester, and I have also handled several large timber sales that my company purchased from the Forest Service, so I know something about these various phases of management other than fire protection.

I have a lot of friends in the Forest Service, and whatever I say here certainly is no reflection on them, and it is constructive, I hope.

I will try to skip, Mr. Chairman, some of the things Mr. Schofield said, because I have worked with him a long time and it is natural I am going to come up with some of the ideas he has.

All wildfires start small and must be controlled small if the desired protection status is attained. A large area fire can only be prevented in 1 of 2 ways—I would like to emphasize this idea of fire prevention. There are only two ways to prevent a big fire: One of them is to keep it from starting in the first place, and the second is to get it out when it is small.

In this connection, I would like to compliment whomever should have such compliment—the sportsmen in our area, the people that use our area—because in those 17 years up there I say that they have done a darn good job of fire prevention. You cannot put 20,000 or 30,000 hunters out there in the worst part of the fire season in California and not have any more fires than we have had, and then say those fellows are not doing a good job of fire prevention.

When you fight a war you have airplanes, submarines, all of the various aids, but you still have to have people on the ground—the old foot soldier.

During the depression years we had the Civilian Conservation Corps. We had men scattered all over the woods, a lot of people working on the grounds, and they did a pretty good effective job of initial attack on fires. During the war, of course, our fire-fighting forces, both in industry and in the Forest Service, were naturally lessened because of the war, but then we had lessened use of the forests, so we did not have the same fire problem during the war years.

Since the war years—and I am telling you now just what my experience has been—in that area there has been a steady decrease of what I call on-the-ground forces. I mean people that are there for initial attack, just the same as the fire department in the city is there to go to a fire as soon as reported. There has been a steady decrease in that type of personnel in the fire service.

We had fire crew stations that were manned in 1946 that are not manned today. Our forces are more centralized. That may be quite possible because of better transportation, but we do not have the initial attack. We rely on other people whose job is not initial attack, is not fire protection, for initial attack on fire.

You heard yesterday, I suppose, although I was not here in the morning, about the survey that was conducted by the California Division of Forestry to determine the adequacy of fire protection to the lands under their protection status. I will not go into that, but I would like to say that from that plan came a setup where the Forest Service on those lands inside the national forests, private lands, that they contract to protect in accordance with the contract issued by the State of California and are paid to protect, were required in 1957 for the first time to locate fire crews in such a manner as was described by the State in the contract.

This is the first time that actual crew locations were stipulated to protect a given segment of forest lands. It is getting back to what we had actually before the war—the idea being to have a crew with equipment and manpower capable of putting out a fire when they got to it quick.

The Chief Forester of the United States, in his annual report of 1951, said, and I quote:

> The Forest Service protection forces and facilities in the national forests today can cope with fires that break out during periods of normal or better than normal fire weather. But they are spread too thinly to insure against serious losses when unusually bad fire weather occurs. As a matter of sound business, the Forest Service should be enabled to build a fire-control organization of sufficient strength to assure adequate protection of those values.

In my opinion, it would not be possible for the Chief Forester or anyone in the Forest Service to make the statement that is even in that first sentence today. An excellent normal weather fire record is of little credit to a protection agency after the occurrence of a disastrous fire which is blamed upon critical fire weather.

I am not unaware of the advances which have been made in this cloud modification, airplanes, and various other things. These techniques are good, but we have to recognize they are only tools, just the same as the bulldozer was when it was first used in fire suppression.

We still have to rely on well-trained, efficient, first-class fire fighters getting to a fire quick and keeping it small.

I say here that I am probably not qualified to make an evaluation of the ratio of overhead to on-the-ground forces in the Forest Service, but I think it would be a splendid idea for the Congress of the United States to make such an evaluation. I think we can more efficiently spend this fire protection and suppression funds we are now allocating for that job.

Thank you very much, Mr. Engle.

The CHAIRMAN. Thank you, Mr. Reed.

(Mr. Reed's prepared statement follows:)

STATEMENT OF WALLER H. REED, CHIEF FORESTER, COLLINS ALMANOR FOREST, COLLINS PINE CO., CHESTER, PLUMAS COUNTY, CALIF.

Knowing of the area of my experience, Congressman Engle in tendering me an invitation to this hearing undoubtedly realized my comments would lean toward northern California. Actually, however, such is not of consequence, for forest and wild land protection from fire is basically the same problem almost anywhere in the West.

May I stress that I am not appearing as an expert; rather, my comments are based upon experience and observation during some 17 years of contact with the United States Forest Service in connection with my work as forest manager of a privately owned tree farm comprising some 90,000 acres adjacent to and intermingled with lands managed for the people of the United States by the Forest Service.

I am a graduate professional forester and a member of the Society of American Foresters. My experience in purchase and operation of Forest Service timber sales plus my observations of the many activities of forest management, including forest fire prevention and control, prompted me to accept the invitation to appear here and offer my opinions.

Please recognize that these opinions are my own and are submitted constructively, no reflection intended upon any of the officers of the Forest Service, many of whom, naturally, I have come to know and appreciate as friends.

All wild fires start small and must be controlled small if the desired protection status is attained. A large area fire can only be prevented in one of two ways—preventing the fire start in the first place, or extinguishment of the fire while it is small.

Obviously prevention of fire starts is the best protection. Continuous and expanded education in fire prevention is certainly worthwhile endeavor for all. In this connection, the sportsmen and other recreational forest users deserve a lot of credit. In spite of rapidly increasing annual usage of the forest areas by the public, the number of fires on our lands have decreased, which in my opinion certainly proves the value of prevention education.

But fires will and do start. Each start during our normal or above normal fire weather is a potential big fire, and therefore, must be controlled early. Such control is possible only when fire control forces are on the fire soon enough and in sufficient strength; in other words, early control demands ever-ready fire department technique.

In my opinion, the United States Forest Service does not provide such fire suppression striking force on the ground, and I emphasize "on the ground," for, as I observe, although the Forest Service has steadily increased in numbers of personnel and appropriations, there has been a corresponding decrease in on-the-ground forces.

During depression years the manpower of the Civilian Conservation Corps provided an almost inexhaustible supply of fire suppression force well distributed throughout the forest. Prior to World War II, on-the-ground striking force was the axiom as evidenced by quite satisfactorily located and supplied fire-control crews. Granted, these forces probably were never numerous nor strong enough to cope with the disastrous fire, but, in my experiences, were responsible for preventing many large fires. Through the war years, on-the-ground forces were, obviously, lessened, however, results were not grave for forest use by the public was also very much curtailed.

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"On the ground" forces have steadily decreased during the years following the war. Former fire crew locations are not manned, or if so, are reduced substantially in striking force. Emphasis, rather, is use of other forces to supply "on the ground" fire suppression, such as the various Forest Service work crews employed mainly for purposes other than fire control and employees of lumber companies and other private agencies, the principal endeavors of which are, also, other than fire control. These "outside" forces are excellent reinforcements on large fires, however, they should not be classed as initial attack fire control—their endeavors and locations are not conducive to rapid dispatch when a fire occurs.

The recent survey of the California State Division of Forestry emphasized the lack of initial attack fire suppression force on the national forests. This survey was ordered by the State board of forestry to determine the adequacy of protection provided to wildlands by the State for those lands the protection of which is the responsibility of the State. Such a statewide survey, obviously, included the adequacy of protection provided the private lands inside the protection boundaries of the national forests, which protection is the responsibility of the State but is supplied by the Forest Service in accordance with a contract to do so with the State. Until the current year, the consideration paid the Forest Service by the State in connection with the aforesaid contract was "pooled" with national forest protection funds, the suppression effort purchased therefrom being spread over all the lands within the national forests.

From the aforesaid statewide survey the State division of forestry developed a fire plan, a part of which designated the location of "on the ground" crews and the suppression power of those crews necessary to protect the private lands within the protection boundaries of the national forests. Thus, this year for the first time, the contract granted to the Forest Service by the State for the aforesaid private laid protection by the Forest Service requires on-the-ground forces, tied to location and of specified strength of manpower and equipment. These crews are fire department status, designated primarily for fire control for a designated area. Effective protection of national forest lands demands similar technique.

The Chief Forester of the United States Forest Service said in his annual report for the year 1951, on page 9, and I quote, "The Forest Service protection forces and facilities in the national forests today can cope with fires that break out during periods of normal or better than normal fire weather. But they are spread too thinly to insure against serious losses when unusually bad fire weather occurs. As a matter of sound business, the Forest Service should be enabled to build a fire-control organization of sufficient strength to assure adequate protection of those values."

In my opinion, it would not be possible for the Chief Forester to make the statement contained in the first sentence of that quotation today. Here in California we annually experience "normal" fire weather which from the standpoint of wild fire is always dangerous, and these normal conditions can change to abnormal on short notice. An excellent normal weather fire record is of little credit to a protection agency after the occurrence of a disastrous fire which is blamed upon critical fire weather.

I am not unaware of the advances in the use of cloud modification as a tool in the prevention of fire, and the airplane as an aid in fire control. Such techniques, as was the case when the bulldozer was introduced as an aid in fire control some years ago, are encouraging aids, but at best are only tools, and cannot be relied upon to replace the efficient, well trained and equipped suppression crew in initial attack on each fire start.

Probably I am not fully qualified to evaluate the present overhead—"on the ground" ratio of the Forest Service allocation of appropriated funds. It is my opinion, however, more "on the ground" force is required to supply the degree of forest protection necessary and desirable on the national forests; and that Congress might well make such an evaluation to determine the feasibility of channeling more of the presently appropriated funds into the woods.

The CHAIRMAN. Mr. Ralph L. Fenner. Is he here?

Mr. FENNER. Yes, sir. I do not have a prepared statement with me. I left it in Berkeley yesterday before I left. I would like to present a summary, and I can submit the prepared statement to you for your record.

The CHAIRMAN. That will be perfectly all right, and the prepared statement will be made a part of the record when submitted.

May I suggest, Mr. Fenner, you try to limit yourself to the prescribed 10 minutes, because we are not moving fast enough, and I am going to run out of time before I run out of witnesses.

STATEMENT OF RALPH L. FENNER, FENNER & DAY CO., RICHMOND, CALIF.

Mr. FENNER. I believe that great French statesman, Clemenceau, said, "Wars are much too important to be left to generals." Perhaps this is something that we should also consider in our fire-control operations, since there is a tendency at times to attempt to provide protection for protection's sake rather than to evaluate the problem, which is to reduce damage and also to reduce potential damage, which is most important, the continual threat of disastrous fires.

The problem, as I see it in California after 15 or 20 years of work—incidentally, I am a private consulting forester, a forest comburologist, specializing in forest-fire work, wildland fire problems. I have worked for the Forest Service, for the State division of forestry, and in research as well as a regular line fireman.

I think one of the basic problems that we face here today is something that I have not heard resolved, and that is: What is this brush we are talking about?

When we have an area like southern California where the sun is shining on it and where there is a certain amount of water, to grow up, if you will, the nuclear energy from the sun is converted by the chlorophyll process and the energy is stored. This accumulates at the rate of tons per acre.

During the initial stage of growth, during the first 10 or 12 years, this accumulating cellulose has a considerable amount of water in it, and therefore it is not easy to burn. As the brush becomes older, the quantity of water in the brush reduces until a mature or overmature stage, and under very dry conditions, under the drought conditions we have here in the fall, there is very little moisture in the fuel, the fuel that is accumulated from a few tons per acre to anywhere from 25 to 75 tons per acre. Expressing that in terms of nuclear energy, I think it has been expressed that 40 acres of this kind of brush is equivalent to a 1-kiloton atomic bomb.

Therefore, conflagration conditions grow; they grow without brush. It is not a static condition.

The areas of the east highlands, Inaja, Malibu are practically fireproof today. Twenty years from now, 30 years from now, they will be up to optimum or maximum conflagration potential again. They will be depleted by fire, and then they will build up again in the traditional way. This has been going on for a long time. We have our brush fields in southern California, as far as I am able to determine, on approximately a 20-year rotation burning, burning rotation at the present time.

I prefer to think of this as the standard rather than the standard being that the brush is not going to burn. I think the historical evidence is such that we know that the brush is going to burn, it is burning on a 20-year rotation. Anything we can do to extend that rota-

tion or reduce the damage from the fires that do occur I think is worthy of consideration.

What is a conflagration?

I believe that a conflagration is a natural consequence of management of brushlands where provision is not made for periodic reduction or harvesting of the fuel.

Conflagrations can be regarded as floods of fire. These floods occur when fuel accumulates to a critical level and then the barriers to burning break down. Conflagrations can be contained by reducing fuel accumulations below the critical level or by increasing the strength of the barriers to contain the energy which is released.

In forest management, fuel is removed or reduced by the logger who takes the fuel out of the forest, cuts it up into lumber, and makes houses out of it. On rangelands fuel is reduced by livestock, converted into beef, brought down to the city where people eat them.

Under current watershed management practices fuel is accumulated indefinitely. We build up the fuel, we do not remove it.

Brush fuel increases in quantity and decreases in moisture content with age. The result is a constant increase in flammability with time. Therefore, the climax or equilibrium state of the brush fields in southern California under a policy of fire exclusion is an unstable equilibrium, becoming increasingly unstable with time. That is, we are trying to balance a marble on an upended bowl, which is the classical definition of an unstable equilibrium, and the bowl is getting higher and gets higher and steeper all the time.

Stabilizing fuel can be accomplished by various tactics. Light burning is one that I do not concur with in southern California. I don't believe there is any place for light burning in southern California for watershed or range management. The technical reason for this can be found in the height of the thermos lines above the fine fuels which burn under the so-called light-burning conditions.

When we have the high level of a forest the temperature for scorching leaves will not reach the lower leaves.

When you are dealing with the elfin forest of southern California any light burning will scorch the leaves and kill them, and you get a hopeless situation in terms of building up a greater conflagration potential than you reduce with light burning.

However, light burning—as it is commonly called, broadcast burning. We will think of it in terms of broadcast burning. There are techniques that have been developed in recent times wherein local areas that are going to give trouble are removed.

The technique has been referred to—one of the techniques—of using fire to do this job. My reason for using fire is why not use the local source of energy. If you have got tremendous energies available in terms of tons of fuel per acre, why not make this work for you at low cost, at low extra cost, rather than bringing in crews of men at high cost, and bulldozers at high cost, and do the job, if it can be done, with the energy that is available on the ground sensationally and effectively.

Area ignition is a technique that was developed to burn these small areas—to use fire, not to burn—to use fire to use these energies effectively for removing local trouble spots in the energy blanket that

covers southern California or the rest of the State. It may be compared to the operation of removing an appendix. If you have a good doctor and he has a good scalpel, he can remove these trouble spots without any unnecessary hazard. I mean there is always the problem that the hazard is there, but is very low.

On the other hand, if we want to return to the period of the times of Pleistocene and not recognizing germs, if we are going to allow amateurs to approach the trouble spots with butcher knives, we are going to have trouble when the appendix is removed.

My only statement here is that, if we are going to use fire in southern California, this is not the sort of thing that can be turned over to anyone to carry out. It should be turned over to engineers, gentlemen, specializing in these aspects of fire control, not necessarily of fire extinguishment. I believe there has not been a tendency for people to recognize that there is even such a field as forest comburology. I use that term to define the kind of work I do. It is a new term.

Mr. RHODES. How do you get it?

Mr. FENNER. Comburere, the Latin, to burn, and ology. I define it as the science dealing with forest fuels, their combustion properties and phenomena, and their distribution, with special reference to forest protection and the use of fire as a cultural tool in the management of forest land.

The CHAIRMAN. Mr. Fenner, the time for your statement has expired. It is a very interesting statement. It would be appreciated if you would reduce that to writing and send it to us so we can include it in the record. I am sorry we have such a short time.

(Committee Note: No response to a reminder mailed October 31, 1957.)

The CHAIRMAN. Is Mr. A. W. Walker present, consultant for the California State Senate Interim Committee on Forest Practices, 415 Andresen Building, San Bernardino, Calif.?

Mr. WALKER. Yes, sir.

The CHAIRMAN. Do you have a prepared statement?

Mr. WALKER. Yes, I have; and I would like to briefly hit some highlights and some other issues developed since the hearing started.

The CHAIRMAN. In order to keep these things on the level for those who testified in this group, the Chair is going to recognize you for 10 minutes. After this we are going to cut everybody back to 5 minutes because we are up to 21 witnesses.

To those who have prepared statements, let me say when the prepared statement is handed to the members of the committee we try to scan the statement while the witness is testifying. As a consequence, we get both jobs done: We listen with our ears and read the statement. As a consequence, we can get through this pretty readily.

I realize the inadequacy of the time, and I am sorry to have to cut some of the witnesses short, but I would rather have a man have 5 minutes than no time at all. If you have a prepared statement, we do pretty well.

So you go right ahead, Mr. Walker.

We are glad to have you here and have you testify.

STATEMENT OF ARTHUR W. WALKER, CONSULTANT TO STATE SENATE INTERIM COMMITTEE ON FOREST PRACTICES, SAN BERNARDINO, CALIF.

Mr. WALKER. Mr. Chairman and members of the committee I am consultant to the State senate interim committee on forest practices.

Mr. Chairman, it will interest you to know that State Senator Swift Berry, of Placerville, is on the committee, and Stanley Arnold, of Susanville, was on the committee but has just been appointed superior court judge. So we are serving with two men, both from the north.

I also serve as chairman of the Tri-County Fire & Flood Prevention Association, which is an organization mentioned yesterday, 1 of the 4 civilian groups that are supporting the program in southern California and which is being coordinated by the Southern California Watershed Council, of which I am a director.

Three members of these four civilian groups serve on this coordinating watershed council, of which Mr. Carter, of course, told you yesterday. He is the chairman.

When in San Bernardino I think you had the privilege of flying over that area, and you saw for approximately 12 miles just adjacent to the city of San Bernardino that our entire watershed has been denuded and that those barren slopes now point like a dagger right into the city of San Bernardino.

There is one thing I want to mention particularly here, and that is our two phases to this program as I see it. One, which we discussed yesterday, is that when a fire once breaks out you have the emergency funds to combat the fire, and it is very expensive and ran into millions of dollars according to the testimony yesterday.

Then, on the other hand, we run into an emergency which must be met in the way of flood control. We have our engineer here from San Bernardino County, and he will give you undoubtedly the details of those figures. But some time ago I figured that the direct flood control—what has been done and what will have to be done in the future—will probably amount to more than $50 million in order to preserve the welfare of the people in that valley.

You have had mentioned to you the amount of money we feel is necessary to bring about adequate fire protection and suppression. This program, I want to emphasize, was developed by the four southern California supervisors who are charged with the responsibility of meeting this responsibility.

We have tabulated this expense account, manpower and equipment, and as we have received additional funds from Washington we have detached from that program, say, 1 man here or 1 bulldozer there. So that when we came back to Washington we were not just there with our hand out. We could give you a concrete example of where the money had been spent, and how, so you could evaluate our request.

California, I presume, has the reputation of always being back asking for money, but we do in California have these critical situations, particularly with regard to fire and flood control.

As the boys told you, we have been back there on several occasions, and in the Senate we have had our budget increased. It has gone back to three conferences. Senator Mansfield's committee, as the tes-

timony has shown, gave a certain percent increase, which has been quite a percent increase in a small way.

In my opinion, we never will stop all the fires. But you mentioned a phrase yesterday, that we got the cart before the horse. I will bring a phrase in here today, that we are locking the door after the horse is stolen.

If we can spend part of that money the Federal Government appropriates for the suppression of fires, and if we could conserve, therefore, part of the money that the Federal Government spends for flood control, we would more than amply man and equip our Forest Service. And it might be well to have a trial, because in that case you are saving not only the forests for recreation—and by the way, San Bernardino Forest has the largest recreational travel of any forest in the United States. The Angeles fellows might dispute that, but they have approximately 6 million people, and 85 percent come from metropolitan Los Angeles. So it is really not a local county project. You would preserve that recreation; you would save our watersheds.

Now I want to come down to the point I think this committee realizes, and I know the Forest Service appreciates it.

You are doing here, yesterday and today, one of the greatest services that could be done for the West. You are digging into the very core of the security and livelihood of the people of southern California.

Without the water we are an arid area. We are having the greatest impetus of population, which is not necessarily solicited, but as a result of the war young boys were out here and saw California and came back, and we must preserve this economy.

In San Bernardino County our economy is based on mining, recreation, agriculture and manufacture, and they are all, in turn, based on the water.

All of the water in the eastern part of our valley is local water—I want to bring that point out—and unless we can conserve and build up the water, which is fast declining, there is going to come a point where our economy is going to be stifled and we are going to go into kinks in that region.

I did want to emphasize particularly those expenditures on the fire prevention and also the flood control, which will be dealt with later.

In our meeting of the State senate committee—and we have had one meeting, Mr. Chairman, and there are a few interesting things I think are not readily known here but were testified to.

We are meeting with a tremendous increase in incendiary fires. The teen-ager is setting these fires throughout the mountains, and we are going to have to do something about it.

Chief Klinger, not here today, brought it up at the last meeting. Certainly if you had a young son you would not want him electrocuted, but we are going to have to do something about it. They will take a little pack of matches and a lit cigarette, put a rubber band around them and throw it out, and by the time the cigarette burns back to the head of the matches they are gone. We are finding those. In some instances several thousands of acres have burned as a result. We must have laws in order that the penalty will be severe enough and uniform.

When I left San Bernardino the day before yesterday—I want to bring this out—the supervisor of San Bernardino Forest was practically running an academy for the State Forestry School in training men, because 10 of his keymen are taking examinations to go either to the city or State forest service. You cannot build up an efficient organization on that basis.

If there is one thing that we received out of civil deefnse—and I was connected with that for 12 years—that has been brought out here is this mutual aid. I have been on forest fires up in our area when we had city, county, State, and Federal forest equipment all fighting a fire up in the mountains. The one who gets there first is the one that starts on the fire.

And we are going to have to have now, in my opinion, in this forestry program area surveys, which the boys are doing, so we can have 15-minute attack in critical areas, 30-minute attack in other areas.

You may say that money is not necessary, but it is necessary to build up that type of approach to the fire. Once a fire gets away, of course, it is almost impossible. I have seen the humidity almost zero, and the wind 75 miles an hour. I do not know how a human force can combat that.

Another thing we have done in the mountains where I was located, we had our water system, and we put tanks up to the mountains with hydrants down the canyons for the Service, and contributed that cooperation to the Service. It did not cost much, but it was a tremendous advantage. We are going to have to develop our water supply throughout the mountains, and you have probably heard there is a big project on water development in the San Bernardino mountains.

Another thing we have been mentioning is the storage of water. Our slopes are so precipitous that the economic justification of the amount of water that you can impound behind dams would create a terrifically high dam, with practically not sufficient water to warrant the cost.

Unlike other places, our mountains start almost at sea level and go up in many instances to 10,000 feet. We are appreciative of that problem.

I think, Mr. Chairman, that I will conclude with that.

We in our Senate committee are going to try to work out this phase, which I think is practical. We are going to try to evaluate to see how the fire districts are meeting their responsibility in these mountain areas.

We have some fire districts that are taxing themselves over $2 a hundred. We have one flood control district that is taxing the people for flood control and putting part of the money into fire protection in the way of preplanning, which we fell now is so very important.

We feel there should be some coordinated program with the military in the way of aviation, because those men are working cooperatively with us, and many of them on their own time and at their own expense and without, really, a unified program. It is certain that helicopters and airplanes, particularly in the last few months, have played a very important part in our combatting fires, and there is a wonderful future in aviation along with the other phases of our protection.

Thank you.

(Mr. Walker's statement is as follows:)

STATEMENT OF ARTHUR W. WALKER, SAN BERNARDINO, CALIF., CONSULTANT TO STATE SENATE INTERIM COMMITTEE ON FOREST PRACTICES; CHAIRMAN, TRI-COUNTY FIRE AND FLOOD PREVENTION ASSOCIATION (SAN BERNARDINO, RIVERSIDE AND ORANGE COUNTIES); DIRECTOR, SOUTHERN CALIFORNIA WATERSHED COUNCIL

ADEQUATE FOREST AND WATERSHED PROTECTION NEEDED IN THE NATIONAL FORESTS OF SOUTHERN CALIFORNIA

The people using the recreation, watershed, and commerical areas of mountains in San Bernardino, Riverside, and Orange Counties, and the investments and values, both public and private in and adjacent to the national forests, are dependent for their safety and continued operation upon the forest fire protection given the entire mountain watershed areas.

Figures from the office of the San Bernardino National Forest in San Bernardino indicate that about 122 forest fires occur annually; 41 of these are caused by lightning, others from burning buildings, burning vehicles, children playing with matches, smokers, airplanes, etc. Forest traffic counters recorded over 5,800,000 visits within this forest in 1956. There are 102 youth camps, about 50 campgrounds, and 19,000 residences in the mountains of this forest. The combination of heavy public use, lightning, steep topography, extreme fire weather and high hazard flash fuels create a serious year-round fire problem.

Flood control expenditures have increased manyfold because of the denudation of watersheds in the area adjoining the city of San Bernardino. The Corps of Engineers is working on one $7 million project, another $7 million is planned for 1960. The county flood control district recently voted a bond issue exceeding $3 millon for flood-control work in this critical area. Recent studies in a nearby area made by the California Forest and Range Experiment Station indicate that partial denudation of the watershed by fire increased the peak water flow 68 times normal, and the erosion rate from 2,000 cubic yards per square mile per year to 55,500 cubic yards or 28 times normal

The densely settled urban and suburban areas lie close to the steep and rugged mountains and erosive soils of the national forests from which the destructive floodwaters pour down. Seeding of the burned areas with grasses and mustard has been done by the Forest Service and is financed through cooperation of the counties, the State, and the Department of Agriculture. The fast growing plants serve as a temporary measure to retard runoff for several years after each fire before the native weeds and shrubs take over.

The Watershed Fire Council of Southern California requested the Forest Service to make a careful study of their needs. These estimated needs were compiled by the supervisors of the four southern national forests and have been presented by the Southern California Watershed Fire Council before the Senate Subcommittee on Appropriations Committtee, 84th Congress, and are a matter of record.

ADEQUATE PROTECTION FOR THE NATIONAL FORESTS OF SOUTHERN CALIFORNIA, A 10-YEAR PROGRAM

TABLE 1.—*Funds required annually, in addition to fiscal year 1954 appropriations, for adequate protection of national forest land*

	Operation and maintenance [1]	Capital investment [2]	Total
Angeles	$515,000	$195,000	$710,000
Cleveland	210,000	102,000	312,000
Los Padres	495,000	325,000	820,000
San Bernardino	348,000	185,000	533,000
Total	1,568,000	807,000	2,375,000

[1] Operation and maintenance: The above dollar estimates for operation will employ, train, equip, and house 750 vitally needed additional firemen.

[2] Capital investment: The above dollar estimates for capital investment will permit the construction of the firebreaks, roads, trails, water developments, and heliports vitally needed to enable the increased forces to operate effectively to provide adequate protection. These increases will also permit the forests to complete the preplanning required on all areas to facilitate the prompt control of fires which are not controlled during the initial attack.

Last year Congress appropriated $900,000 to help meet this need in southern California. An additional amount of $1,475,000 is still needed annually to meet the needs of adequate forest-fire protection as presented.

In addition to this amount, it is strongly urged that additional funds be appropriated for forest-fire research in southern California. The fire hazards, weather, topography, and fuels of southern California are of such extremes that reseach findings from other areas do not always apply. It is very possible that military, university, chemical companies, airplane companies, and many other agencies will pitch in and give their wholehearted aid and support for this program that is not only worthwhile but is mandatory for the economy, safety, and health and enjoyment of the millions of people in southern California.

The foregoing is a brief review of the situation in southern California, particularly as it affects the San Bernardino National Forest. Now, to summarize the salient facts I will pinpoint the following:

1. Sufficient fire-control funds have not been made available to adequately protect the national forests of California from their most dreaded enemy—fire. The above figures briefly set forth these deficiencies in dollars and cents.

2. Ground cover is essential in the retardation of runoff water on our precipitous slopes which helps to control devastating floods and also in preserving a usable water supply. Storage dams in most canyons are economically unfeasible because the steep slopes do not permit the storage of economical quantities of water at anything approaching a practical cost. Control burning in southern California is hazardous and a substitute ground cover must be found to prevent erosion.

3. To cope with the problem of fire prevention and control, the following must have your serious consideration:

(*a*) Adequate manpower and sufficient equipment for an efficient striking force.

(*b*) Preplanning to the end that all areas are made approachable for the combating of fire. This should include access roads, convenient water-supply sources (areas should be blueprinted so that any fire-control officer could judge the proper approach to the fire, not only from the standpoint of accessibility but also for the protection of human life).

(*c*) Research: Too much emphasis cannot be placed on the subject. In the overall fire protection it is vital.

(*d*) The advent of airplanes and copters into the fire-fighting program is an activity as yet only in its infancy, but it already has been an important adjunct in the control and extinguishing of forest fires. These airborne carriers are swift and can approach many practically inaccessible areas and at least retard a fire until ground crews and equipment can meet the situation. They have been used to advantage to date, and with improved water or chemical capacity their value cannot be underestimated. They should lend themselves to controlling lightning fires that start in remote treetops and which could spread with velocity if not hit with control within a few minutes. The use of planes, however, is limited to daylight hours only and cannot be used during the strong Santana winds which are prevalent during the late fire season.

In conclusion, I wish to emphasize the fact with which you are familiar: California is experiencing an unprecedented population growth, and particularly in southern California. Water is the prime essential to the well-being of every man, woman, and child. Their very destiny is wrapped up in the precious watersheds of our mountains. The protection of these mountains is the responsibility largely of the Federal Government, and in turn the National Forest Service, due to the fact that a substantial portion of these lands are under Federal ownership and control. There is no greater challenge than to protect this security for your people and certainly no cause more deserving.

The CHAIRMAN. Thank you very much, Mr. Walker.

Thank you all, gentlemen, for these excellent statements.

I might say, Mr. Schofield, there is one statement made here that attracts me, and that is on the fifth page of your statement, where you say that on a review you "find 95 percent of the fires which occur are controlled by present crews."

It seems to me that we had figures that indicated up to 98 percent of these fires were kept to very small acreage, which indicates, as stated here, that "the present initial attack is good and increasing the number of men or the equipment would do little better."

The thing that concerns me is the sort of testimony we had yesterday which indicated that no amount of crews and no speed of initial attack would have stopped that fire out there in Los Padres National Forest. The situation had developed, as Mr. Fenner has stated, to the point of combustibility where the only thing you can do is get out of the way. I am afraid that there is just going to have to be more imagination put into the solution of this problem. You may have a fellow standing there with a fire hose every 15 feet, and when the fire starts the only thing he could do is to run for his life. There just is not any argument about it.

I think perhaps we may have to come up with a fire-resistance spray and spray these brush patches, get some asbestos or something to put on them, so the root structure will not be affected and their capability of preserving the watershed will not be impaired but the flammability of the area will be reduced.

You get up to the point of where you are holding them up to 98 percent, and still when they hit there is nothing in the world you can do but run, and you have got to start figuring out something else.

I am very much impressed with this testimony.

Mr. Fenner, I hope you will reduce your statement to writing, because I was interested in your approach to it. I have no questions.

The gentleman from California, Mr. Sisk.

Mr. SISK. Mr. Chairman, I just want to comment also on page 5 of Mr. Schofield's statement, but I think that has been brought out enough.

In trying to think over the testimony we have heard the past few days, of course, having been an advocate to some extent over a period of years of controlled burns, I am inclined to believe, as I analyze all of the testimony that we have had here, that this energy is piling up, and it is going to blow up and burn eventually.

We had your statement here this morning, by the way, Mr. Rogers, in which you indicated that these burns are occurring upon an average of from 10 to 20 years. I believe Mr. Fenner's statement indicated that the fuel accumulation developed. So I am becoming a little concerned about some of the bullheaded attitude, apparently, of some people in refusing to acknowledge and face up to the facts.

That is no criticism of the Forest Service or some of my friends in conservation and the watershed people down here. I think it would certainly be far better to go out here and have some controlled burns and get rid of some of this energy than it is to just apparently admit you are going to have a wild fire and destroy a lot of people and a lot of property about every 15 or 20 years.

I want to commend you, gentlemen, this morning on your statements. Particularly, Mr. Fenner, I will be looking forward with some interest to reading your written statement.

That is all, Mr. Chairman.

The CHAIRMAN. The gentleman from Arizona, Mr. Rhodes.

Mr. RHODES. Mr. Chairman, I have a couple of questions.

Mr. Fenner, I was interested in your suggestion that maybe some of this energy should be harvested. How would you go about harvesting the energy which is built up in certain areas?

Mr. FENNER. I believe my statement was to reduce or to harvest it. At the present time there is a certain amount of discussion about

eventually making some use of the brush species that we have in southern California.

Mr. RHODES. Is there any use now that you know of, any economic use?

Mr. FENNER. I would not go so far as to say there is no economic use. I believe right now our highest use of brush in southern California is for watershed protection. I would like to add that I believe the best brush is the oldest brush for watershed protection.

Mr. RHODES. And yet that is the most inflammable brush also?

Mr. FENNER. That is the horns of the dilemma that we face here in southern California which I think probably should be recognized.

Mr. RHODES. Tell me, what is the difference between area ignition, light burning, and control burning?

Mr. FENNER. Everyone probably has his own definition of this.

I do not use the term "control burning" in my business. I cannot. My insurance would not hold if I had any doubt any fire I was on was going to be controlled, and I have to take full responsibility for any fire that I set. That is a fact.

Control burning, to me, is aimed at what you are attempting to control. If you are attempting to control brush, then it is brush-control burning. If you are attempting to control hazards, it is hazard-control burning. If you are attempting to improve vista, which many livestock men do—it is easier to handle cows if you can see them—they call it vista-control burning.

The value—I am a forest economist, and I deal with values, and I deal with specific problems, and if someone wants to do a job of controlled burning they pay me because they——

Mr. RHODES. What is area ignition? Let's get to that one now.

Mr. FENNER. Area ignition technically is the rapid distribution of fire throughout an area almost simultaneously. If you will look at the flag in the background, the area ignition pattern is the one in the upper left-hand corner.

The bush burns in less than 2 minutes, and the maximum length of radiation is 2 minutes regardless of whether you are burning 1 bush or 40,000 acres of bushes.

In order to get these bushes to work together under difficult burning conditions, to get efficient burning, we found—the research was while I was at the California Forest Range Experiment Station—by using saturation firing techniques in igniting large areas so they burn together, burn simultaneously, that we have tremendously increased efficiencies of burning, fivefold, tenfold, a hundredfold increases in efficiency of burning, through these techniques.

Mr. RHODES. Do you have any ideas as to how you might handle erosion after an area burns?

Mr. FENNER. You would not consider here again that you were going to burn an entire watershed. When I think of burning critical areas—may I present a photograph?

Mr. RHODES. You will have to make it very brief because my time is up.

Mr. FENNER. In other words, we have done this on areas of 1, 20, or 30 acres, some under very difficult conditions.

Mr. RHODES. If you have a photograph, will you present it for the file?

Mr. FENNER. It will be included in the file with the work we did with the university.

The CHAIRMAN. Include it with your statement when you submit it.

Again I regret we cannot be a little more deliberate about this.

I want to thank you all for your testimony.

The next group of witnesses are people who appear either in official or semiofficial capacities, and you might as well all come up at once.

Mr. W. E. Silverwood; Mr. Break, who is represented by Mr. M. A. Nicholas; and Mr. F. R. Jewett.

I want to recognize each one of you gentlemen for a 5-minute summary statement, and then we will try to get in some questions. If we do not do it that way, we do not have time to ask anything.

Mr. Silverwood, you are recognized for 5 minutes.

STATEMENT OF W. E. SILVERWOOD, DIRECTOR, REDLANDS-HIGHLAND SOIL CONSERVATION DISTRICT, REDLANDS, CALIF.

Mr. SILVERWOOD. Mr. Chairman and members of the committee, my name is W. E. Silverwood, of Redlands, Calif., appearing as a director of the Redlands-Highland Soil Conservation District. This district contains 269,000 acres which includes national-forest land where the recent major Arrowhead, McKinley, and East Highlands fires took place. These fires resulted in 29,000 acres being burned and cost over $1 million to control.

The objective of soil conservation districts is to encourage all district landowners to learn the individual soil characteristics and capabilities of their land and then treat it for its conservation needs. This includes both privately owned agricultural land as well as State and Federal public land.

Soil conservation district farm plans on agricultural lands call for the use of new tillage tools that promote better mulching and humus-producing methods on the contour, so that each drop of rainfall has a much greater chance of entering the ground right where it falls. Excess rainstorms of high intensity are then prevented from doing serious erosive damage because runoff water is forced by contoured terraces and diversion ditches with control outlets to "walk" downhill slowly, leaving invaluable topsoil in place. Flood-retardation dams catch and hold back peak runoff flows so they may drain off slowly into spreading channels to help recharge local and downstream underground water basins. Please remember runoff water caught and held back in upstream conservation-treated land means detained downstream floodwater that could cause needless downstream destruction and misery.

The soil conservation district farm plan treated lands are the greatest upstream reservoir of all, because they will act as a giant sponge to hold a large percentage of their total volume in water which definitely helps prolong the downstream seasonal streamflow. Consequently, the district conservation land-treatment program benefits everyone because every citizen is dependent upon the careful management and proper use of the natural resources in every watershed for his future supplies of food, fiber, forest products, and water.

The unsung hero of this soil- and water-conservation and flood-prevention program is the farmer landowner because he is personally

paying for the major portion of the cost of this program on the agricultural lands throughout the 2,000 soil-conservation districts of the Nation.

All other flood-control programs are entirely supported by county, State, or Federal taxes. Too often the Army engineer concept of flood control in southern California is cement-lined ditches to carry the water to the ocean.

Your committee's enlightening news release shows that the per capita use of water in the Nation has more than tripled in the past 50 years and is expected to continue to increase. This proves that you Members of Congress are fully aware of the tremendous importance of conserving our most valuable annual natural resource, which is our annual crop of water. We must be prepared to harvest our annual water crop as intelligently and as quickly as we farmers harvest some of our perishable fruit crops.

There are times when the major portion of our limited seasonal rainfall in southern California comes in the form of semitropical storms falling at the rate of an inch or more per hour.

This is why our Redlands-Highland Soil Conservation District is 100 percent behind the fire suppression preplanning land-treatment program of the Forest Service on the upper watersheds in the San Bernardino National Forest.

The future welfare of the entire Santa Ana River watershed is dependent upon the success of this program.

Here is an example of what happens from one of these fires. The Arrowhead Springs fire burned 3,300 acres. In spite of a heavy seeding program and a mild winter of below average rainfall with storms of low intensity, 750,000 cubic yards of irreplaceable topsoil and debris washed downstream into the spreading grounds on the debris cone at the floor of the valley. Millions of additional cubic yards of very limited remaining topsoil is perilously hanging in the balance in a race with nature trying to tie it down with plant roots and a new very thin protective cover of leaves and plant humus before a high-intensity storm washes more of it downstream. It is costing the county flood-control department 15 cents a cubic yard to move this debris with bulldozers in the water-spreading grounds. Because of highly improved property immediately adjacent to these spreading grounds it will soon be necessary to load excess topsoil and debris washed in from the burned area on trucks at a handling cost estimated to be from 10 to 15 times the present removal cost.

The real tragedy that can never be fully appraised is the permanent damage to the water retention spongelike mat of heavy ground cover and topsoil that enabled rainfall to enter the ground on the steep slopes and emerge downstream crystal clear. Every time you see a muddy river flowing to the ocean you are seeing golden oranges and peaches, red apples and cherries, loaves of bread and sides of beef going to waste that will never nourish mankind.

Now let me give you an example of what an almost impossible task the Forest Service is confronted with in controlling fires on the extremely steep and inaccessible slopes of the San Bernardino National Forest. Ninety-nine percent of all fire outbreaks are quickly brought

under control. The reason that 1 percent of the small fires get out of control and become big fires is because of the total inaccessibility of this forest terrain.

For example it took fire fighters 3 hours on foot to reach the Deer fire from the end of the nearest road. Under these conditions it is extremely dangerous for fire fighters if a wind should suddenly come up or shift.

Suppose we took a 10-mile square area in the heart of Los Angeles and eliminated all the water mains, alleys, and streets leaving just a narrow street about every 3 miles. Imagine that the vacant areas are filled in solid with small buildings and instead of flat ground you substitute the steep terrain with the deep rugged inaccessible canyons as now exist in the national forest north of San Bernardino. Now, if a jetplane crashed in the middle of this highly flammable area setting it on fire, how do you think the Los Angeles Fire Department could put it out when they couldn't get within a mile of it? This was the exact problem that confronted the Forest Service in the McKinley fire.

How could you expect to quickly bring under control at night the East Highlands fire in an equally inaccessible terrain with the Santa Ana winds howling off the desert causing the extreme powder dry forest terrain to virtually explode.

Incidentally, those two large pictures are of the East Highlands fire, showing the wind coming from the desert over the top of the mountains.

The Forest Service first had to build roads and clear safety zones before they could move men and equipment in to start to combat the McKinley and East Highlands fires last year. No fire-fighting organization can control a fire that they cannot reach. The Forest Service personnel in charge of the San Bernardino National Forest has done an outstanding job with the limited funds at their disposal.

We soil conservation district directors contend it would have been much wiser for Congress to have used the $1 million spent to suppress the Arrowhead, McKinley, and East Highlands fires on upper watershed conservation land treatment measures as proposed in the excellent fire-prevention plan prepared by the Forest Service.

You have a picture of that in the folder.

Then there would have been no permanent damage to the water retention ability of these burned areas. Instead you would have had permanent fire-prevention protection through sufficient access roads, firebreaks and cleared safety zones for men and equipment, helicopter ports and water replenishment stations.

We soil conservation district directors respectfully urge your committee to encourage Congress to follow our example of good land stewardship by providing sufficient Federal funds to carry out the so necessary watershed conservation protective measures on the Federal lands that Congress is actually, legally, and morally responsible for.

Thank you very much.

(The pictures submitted by Mr. Silverwood will be found in the files of the committee.)

The CHAIRMAN. Thank you, Mr. Silverwood.

Now, Mr. Nicholas, do you have a prepared statement?

STATEMENT OF M. A. NICHOLAS, CHIEF ENGINEER, COUNTY FLOOD CONTROL DISTRICT, SAN BERNARDINO, CALIF.

Mr. NICHOLAS. I have a prepared statement to the committee and request that statement be made a matter of record.

The CHAIRMAN. Without objection, it will be included following Mr. Nicholas' oral testimony.

We would appreciate it if you would try to summarize your remarks in 5 minutes while we are looking through your statement here.

Mr. NICHOLAS. I prefer to, perhaps, make some comments other than what is covered by the report to the committee, if the committee has no objection. I will try to keep right to the point, and having appeared before a number of committees at congressional level, I know that time is of the essence.

I would just like to make reference to this map that we have placed on the stand, which shows the area that lies above the city of San Bernardino, which I think is perhaps worth far more than anything I can say in the way of a description of the conditions that exist.

While we realize that controlling of fires by firebreaks and such other methods is a very sound principle, we do not see how we can get or the Forest Service can develop roads in and around those particular mountains at the degree of slope that exists at the present time. You can realize that for almost every foot in elevation you go up you go 1 foot back, or approximately a 45° angle. To try and climb that type of terrain is almost impossible.

The thought of going into the use of helicopters and newer methods, forgetting some of these ideas that have been used in the past and going into the research that has been used by the Federal Government and industry to make the United States what it is today, if we will turn around and use that energy and take the terrific sums of money that have been used to put the fires out and go by the old adage that an ounce of prevention is worth a pound of cure, I think we can accomplish something.

I do feel that along the roads, even with the advances they have made today in the material, or should I say the use of the various types of growth that they have experimented with as fire-resistant growth—that the use of that along the highways, not necessarily taking the material that is there today and just taking it out, but replacing it—because to maintain a large area along the main highway and prevent the people from getting out and getting into that brush and starting fires is impossible. As a result, if they could use along the highways for certain areas, perhaps three or four hundred feet, for developing existing resistant material to fire, we would then have possibilities of preventing the tendency of some kids riding along the road—not necessarily just children but people using the mountains—flipping out the cigarettes as they do perhaps in a back yard and forgetting about the fact that 1 cigarette or 1 match can cause such a terrific amount of damage.

I think that is the type of development and research that should be used, and I think that is where the money should be spent. We just cannot stand still and say that developing firebreaks and getting the equipment out there is the answer. I think it is the beginning of the answer. It is a step in that direction. But I do think we have to go

and take this transition, and jump across this transition as much as possible, because the people are going to use the area whether we like it or do not like it. They are going to go in there by one means or another. I think that is our only logical approach to it.

Thank you very much.

The CHAIRMAN. Thank you for that excellent statement, Mr. Nicholas.

(The statement submitted by Mr. Nicholas follows:)

A PRESENTATION TO THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS, HOUSE OF REPRESENTATIVES OF THE UNITED STATES, IN LOS ANGELES, CALIF., OCTOBER 9, 1957

Hon. Clair Engle, chairman of the committee, and committee members: On behalf of the county of San Bernardino, Calif., we are presenting to you material at this hearing you have called regarding the disastrous forest and brush fires that are all too frequent in southern California. San Bernardino County, the largest county in the United States, contains the major portion of the San Bernardino National Forest and a great many other Federal installations. Our material is presented on the basis that San Bernardino County has been a self-help agency, doing what is necessary to preserve our local investment and protect our own future. Our material will show, however, that State and Federal agencies need to join hands in an even more firm grip in a true attack on our common enemy, fire.

The mountain areas of California, and particularly of San Bernardino County, are a valuable part of the Nation's playground. This playground is for all of the people of the western United States, and we believe that we will show that the local interests are doing all in their power to protect and develop these mountain resources. We believe it will also be shown in your hearings in California that the United States Government must improve its own participation in the development, preservation and improvement of these natural resources on Federal lands.

FIRE FIGHTING

Private citizens within the San Bernardino National Forest have created seven active special taxation divisions of government for the fighting of fire as their sole purpose. In addition, two communities have created active volunteer fire units, duly organized and operating, but without the benefits of a tax levying power. These 7 operating districts now man 19 operative fire stations. intently cover 52 square miles of the national forest. They keep actively trained 220 effective volunteers. These same people have spent, during the past year, $182,000 and they have budgeted for the current fiscal year $324,000 in an attack on fire. These organized districts pay a tax rate which averages $1.09 per $100 of assessed valuation, which rate is almost twice that of the normal fire district within this county. Almost all developed private property within the San Bernardino National Forest now is included within an organized fire district. These fire districts, with all of their equipment and manpower, cooperate actively with the United States Forest Service and the State division of forestry in any and all fire threats to the entire mountain area.

These fire districts are formed for structural fire protection primarily, but it is obvious that in these tinder-dry areas the greatest threat to improvements comes from inaccessible brush and timber watersheds outside the developed areas and, therefore, fires must be fought wherever they may occur, and such is the dedicated service of each of these districts.

In another attack on fire, the county of San Bernardino has approved and used for 2 years the industrial road camp prisoners of the county in an active fire suppression, under the direction of and through a contract with the United States Forest Service. In addition, this year the board of supervisors has approved the creation of a 10-man fire prevention crew which is working under the guidance of trained staff of the United States Forest Service, and another one soon to be placed under the direction of the State forester. These two active crews will work in creating wide safety areas along traveled roadways, or on any fringe areas that present a possible threat to our watersheds. The best testimony to the results of these services comes from the United States

forester in the area who attests to the value of these crews as early striking forces, as well as fire prevention workers.

In addition to the above local activities, the county, from the general fund, has an annual contract with the State of California Division of Forestry, totaling approximately $130,000. This sum covers the cooperative contract for year-round coverage of the seasonal State stations and provides much in the way of fire rigs, special tools, communications and manpower. This program adds to the mutual aid striking force for forest and watershed fires, and frees city and district equipment in our splendid cooperative fire-fighting program.

AUXILIARY SERVICES

The county of San Bernardino has improved its service on rubbish control and disposal under a cooperative agreement with the Forest Service within the residential and recreational areas of the San Bernardino National Forest. The county is improving its rubbish-disposal program, wherever possible, by initiating cut-and-cover or sanitary fill methods of rubbish disposal instead of burning. One or more dumps will be converted to this type of cover in the current year.

During the past 6 years, the county of San Bernardino has carried on an active and cooperative program with State and Federal agencies in the development of browseways, in upstream control, in spring development, and in other items such as quail guzzler installations. As you gentlemen recognize, these developments are integral parts of the preservation of our forest resources.

During the long fire season, the entire personnel of the San Bernardino County sheriff's office works constantly with the fire services in the maintenance of an efficient arson investigation program and a forest highway control. The sheriff of San Bernardino County maintains a staff with adequate training patrolling the roads through the national forest. The sheriff, with an excellent law-enforcement radio system and many cars, puts in many hundreds of hours each year in preserving a clear roadway through the fire service area and in checking suspicious characters.

FLOOD CONTROL

The San Bernardino County Flood-Control District is divided into several zones with different interests and approaches to flood-prevention problems. One of these zones (zone 5) covers the large part of the San Bernardino National Forest in San Bernardino County, and the budget of this particular zone in this current year provides the following funds which go a long way in showing the demand interest and expenditures of the people who love, and are a part of the mountain watersheds of this county. Following are the four budget items of concern:

1. $20,000 in fire breaks and trail projects.
2. $8,000 for construction on a water pipeline project.
3. $5,000 for pine beetle and insect-control cooperation with the United States Forest Service.
4. $16,000 for expenditure in preplanning for fire control, including water-tank construction.

These are the same citizens who are paying a large part of the fire-control bill through the special districts which were mentioned in the early part of our presentation. Surely, this is concrete evidence of local self-help to get a job done. Zone 3 of the flood-control district has appropriated $2,500 for forest-fire preplanning, in addition to other money that will be made available for the small watersheds development program proposed for this zone (Public Law 566). Zone 1 of the flood-control district is proceeding rapidly in the long-range program for the small watershed development which is an approved project of the California conservation proposal.

In addition to these recurring projects, the county has participated, whenever necessary, in the emergency seeding of burned areas for erosion and flood prevention.

The inseparable relationship between fire prevention and flood control in watershed protection is well understood in San Bernardino County. The handling of huge volumes of swift, moving water and the excessive loads of debris are the direct and terrible results of destructive brush and mountain fires. The counties of San Bernardino, Riverside, and Orange hold regular meetings of their boards of supervisors to consider the mutual problems on these and other drainage-basin concern. The 3 counties have entered into a mutual agree-

ment for the joint representation of our flood and fire problems, and have presented a unified petition before at least 3 State or Federal agencies.

SUMMARY

The maps and facts presented here today must emphasize to you that the San Bernardino Mountains present an area of great present recreation activity and future potential. These same areas also present a most serious fire-fighting problem. The brush and timber covering these mountains and their extremely steep slopes must be protected by every means known to man. Yes, we must even push our research on the new items of fire control in order that these and other similar natural resources in the United States be preserved. The map which shows the 10-mile fire burn in the past few years must be descriptive beyond any of our words of the problem facing the valley areas. The other material we have submitted certainly must show you that the county, in cooperation with local citizens and they, in turn with the State and Federal agencies, have done an excellent job in preserving what we have for the entire national economy. We feel that this demonstrates we are not coming with empty hands when we urge upon you and your committee to do all in your power to see that adequate funds are provided research, prevention, and suppression programs.

Your attention is called to the tabulation submitted herewith which shows that from 1953 through 1956, 79 square miles of valuable watershed and recreational areas were burned from front slopes of the San Bernardino National Forest. The material will show the volumes of debris, the volumes of runoff water, and the summary of remedial measures undertaken at the local level, and we urge that you review this material at your convenience.

It must be clear that in spite of our local, cooperative efforts, fires do and will occur, and we call upon the honorable members of this committee to support an expanding Federal program in every approach to the control or eradication in forest and brush land fires.

Respectfully submitted.

BOARD OF SUPERVISORS, COUNTY OF SAN BERNARDINO,
STATE OF CALIFORNIA.

TABLE S–4.—*Accumulative burns by watersheds (subsequent to Feb. 22, 1953)*

Watershed	Watershed area (square miles)	Burned area (square miles)	Burn date	Percent of watershed burned
Badger Canyon	1.1	0.55	Sept. 25, 1954	50.0
Bailey Canyon	.69	.52	Dec. 27, 1954	75.4
Bald Ridge	.18	.18	Nov. 19, 1956	100.0
Bledsoe Gulch	.79	.06	do	8.0
Brush Canyon	.29	.09	Nov. 24, 1956	31.0
Cable Canyon	3.62	.82	Feb. 22, 1953	
		.44	Sept. 25, 1954	
		2.21	Dec. 27, 1954	
Total		(3.47)		95.8
Cajon Creek	40.9	.94	July 6, 1954	2.3
City Creek	19.8	.53	Aug. 20, 1955	
		11.8	Sept. 21, 1956	
		3.93	Nov. 19, 1956	
Total		(16.26)		82.1
Cook Canyon	.66	.66	do	100.0
Cucamonga Creek	10.3	3.85	Dec. 27, 1953	37.4
Daley (Borea) Canyon	1.21	1.05	Nov. 19, 1956	87.0
Deep Creek	137.0	4.75	Sept. 30, 1955	
		2.3	Sept. 21, 1956	
Total		(7.05)		5.1
Devil Canyon	6.1	4.85	Sept. 25, 1954	79.5
Elder Gulch	1.33	.91	Nov. 19, 1956	68.0
Harrison (Turner) Canyon	.61	.14	do	23.0
Hopper Canyon	1.65	1.32	Dec. 27, 1954	80.0
Kimbark Canyon	1.17	.08	do	6.8
Kimbark (East)	1.05	.12	do	11.4
Little Sand Canyon	1.50	.63	July 4, 1956	
		.87	Nov. 19, 1956	
Total		(1.50)		100.0
Lytle Creek	49.0	1.26	July 29, 1954	2.6
Meechem Canyon	.81	.66	Dec. 27, 1954	81.5
Meyers Canyon	1.35	1.11	do	82.2
Oak Creek	2.38	2.38	Nov. 19, 1956	100.0
Plunge Creek	16.9	1.02	Oct. 29, 1955	
		8.69	Nov. 19, 1956	
Total		(9.71)		57.0
Quail Canyon	.16	.10	do	63.0
Reservoir Canyon	.23	.23	do	100.0
San Antonio Canyon	27.0	7.55	Dec. 12, 1953	28.0
Sand Canyon	3.1	1.7	Sept. 21, 1956	
		1.24	Nov. 19, 1956	
Total		(2.94)		94.0
Sawpit Canyon	2.0	.44	Sept. 25, 1954	22.0
Severance Group	.4	.07	do	17.5
Small Canyon	.81	.81	Nov. 19, 1956	100.0
Sweetwater Canyon	.6	.10	Sept. 25, 1954	16.7
Twin Creek	8.6	5.10	Aug. 26, 1953	59.3
Waterman Canyon	4.6	.07	do	
		.35	Sept. 20, 1954	
		.40	Oct. 24, 1955	
Total		(.82)		17.8
Frontal and miscellaneous canyon areas:				
Del Rosa	.11	.03	Nov. 19, 1956	27.0
Patton	.34	.34	do	100.0
Highlands	.71	.71	do	100.0
East Highlands	.80	.57	do	71.0
North San Bernardino	.20	.10	Nov. 24, 1956	50.0
Miscellaneous valley		1.00	Nov. 19, 1956	
Grand total of burned areas		79.63		

DEBRIS

As hereinbefore mentioned, the areas of Little Sand Canyon, Sand Canyon, and City Creek Canyon are heavy producers of debris which is discharged at the canyon mouths into the developed areas below. Little Sand Canyon and Sand Canyon produce principally sandy-type materials, as do Twin Creek (Strawberry Creek), Harrison Canyon, and Daley Canyon (Borea) to the west. City Creek produces sand as well as coarser materials ranging upward to boulders.

Minor storms of January and February 1954, following the Arrowhead Springs burn of August 26, 1953, delivered an estimated 550,000 cubic yards of sand debris into the San Bernardino County Flood Control District's Twin Creek spreading grounds from the Twin Creek drainage area, of which 5.4 square miles had been denuded of vegetation. This flow represents a unit debris discharge rate of approximately 100,000 cubic yards per square mile of burned area.

During the minor storms of December 22 to 24, 1945, in the Harrison Canyon watershed and following the fire of August 26, 1944, in this area, an estimated 25,000 cubic yards of sand debris was delivered to the Harrison debris basin with a watershed area of 0.60 square mile. This represents a unit debris discharge of 42,000 cubic yards per square mile of area.

By use of plate VIII, developed in Survey Report, Santa Ana River Watershed, by the Soil Conservation Service, April 14, 1942, together with an average of the maximum 24-hour rainfall hereinbefore indicated for the Little Sand, Sand, and City Creek watersheds, it appears that for a period of 10 years subsequent to the burn, average storm deposition of slope erosion as the result of a 100-year storm may amount to values ranging from in excess of 150,000 to 60,000 cubic yards per square mile from the City Creek drainage area and from 100,000 to 25,000 cubic yards per square mile from the Little sand and Sand Creek drainages.

For such storms debris flows within the following ranges may be anticipated upon favorable combinations of hydrologic and watershed conditions during the next 10 years. This would represent a storm flow only, not accumulated debris deposition.

Little Sand Creek: 63,000 to 16,000 cubic yards.

Sand Creek: 170,000 to 43,000 cubic yards.

City Creek: 1,850,000 to 740,000 cubic yards.

The magnitude of these debris quantities afford serious flood hazard threats to the vast existing and rapidly developing valley areas.

Plate IX shows the vegetation zones in the San Bernardino and eastern San Gabriel Mountains, and the zones of chaparral and forest destroyed by the watershed burns.

EFFECT OF WATERSHED BURNS ON WATER SUPPLY

The only present source of water supply for the eastern portion of the San Bernardino Valley is from underground supplies and a small amount from surface streamflow. The underground basin serving the San Bernardino and Highland areas has as its lower boundary the San Jacinto Fault, roughly extending through the Loma Linda area toward Lytle Creek Canyon. It has been estimated that about 85 percent of the runoff from the mountains and hills is retained in the basin area and only about 15 percent of the floodwater crosses the valley floor and escapes across the San Jacinto Fault from the basin.

Because of the higher rates of rainfall on the slopes of the San Bernardino range of mountains, the retention in the rock mantle, streamflow and the conservation thereof forms the basis of recharge of the underground basin a vital necessity due to the heavy draft to accommodate the agricultural, domestic, commercial, and industrial developments of the rapidly expanding region.

In the City Creek Mountain drainage area, perennial ground-water storage is estimated to range from a maximum of 650 acre-feet per square mile of drainage area to a minimum of 170 acre-feet. Seepage from these ground water bodies is important to water users in the valley. In many of the mountain-stream channels there is sustained flow from this source through each summer drought period and in as many as three consecutive seasons in preiods of deficient precipitation.

Storm ground-water storage is temporarily detained storm water entering the rock mantle and raining rapidly into the mountain stream channels. The maximum storage amounts to about 100 acre-feet per square mile in the City Creek drainage area; 50 percent will drain to the channel within about 5 days and about 90 percent in about 18 days after recharge in City Creek.

With a denuded watershed, overland and channel flows are accelerated due to lack of retarding effect of vegetal cover. Flood flow peaks are sometimes estimated at approximately double on burned watersheds, with the resultant loss to the perennial and storm ground-water storage.

In the valley areas, the increased channel flood flows leaving the valley and the vast quantities of debris including ash, silts, and other fine materials which render impervious natural spreading and conservation areas, reduce percola-

tion and recharge to underground basins. With the heavy demand on underground water supplies, it is essential that the natural supply thereto be maintained.

REMEDIAL MEASURES TAKEN FOR PREVIOUS WATERSHED BURNS

As the result of the devastating fires prior to 1955 in the Cable, Devil, Waterman, and East Twin Creek watersheds, and the emergency situation arising therefrom from possible flood hazards, the United States Government through the Corps of Engineers, United States Army, has initiated construction of the Lytle, Devil, East Twin, and Warm Creek improvements at a total estimated cost of $17,258,000 of which $2,275,000 is non-Federal cost, a responsibility assumed by the San Bernardino County Flood Control District.

The aforesaid district has further initiated construction of the north San Bernardino projects for flood-control treatment of earlier devastated watersheds not provided for by Corps of Engineers projects. The north San Bernardino projects have been financed through a $3,425,000 bond issue.

These works when completed will afford a high degree of protection from the watersheds previously destroyed by burns.

The most recent serious watershed burns now poise a serious threat to the easterly sections of the city of San Bernardino, Del Rosa, Highland, and adjoining areas by reason of floodwater and debris deposition. With the city of San Bernardino having property value at approximately $400 million, Del Rosa area at about $20 million, Highland at about $17 million, and the Norton Air Force Base and Patton State Hospital with values probably in excess of $500 million, it is evident that protective measures for the area should be accelerated.

The United States Forest Service has estimated future potential damages in excess of $2,300,000 as the result of the Sterling fire and the McKinley burn.

Zone 2 of the San Bernardino County Flood Control District in order to meet the burdens thrust upon it by past fires has increased its tax levee to the legal limit and assumed bonded indebtedness for the next 25 years. Continued reoccurrence of the magnification of flood hazard threats places unprecedented burdens upon the district.

The CHAIRMAN. Mr. Jewett.

STATEMENT OF F. R. JEWETT, VENTURA, CALIF., VENTURA COUNTY'S REPRESENTATIVE ON THE WATERSHED-FIRE COUNCIL OF SOUTHERN CALIFORNIA

Mr. JEWETT. Mr. Chairman and gentlemen, I have a prepared statement, which I will summarize. I would like to identify myself.

The CHAIRMAN. We would appreciate it if you would give your name, address, and the capacity in which you appear. I understand you are a friend of our old friend, Congressman Teague.

Mr. JEWETT. Yes; I am.

I am a farmer, born in Ventura, and presently living on my farm near Montalvo, 47497 East Bristol Road.

My experience, I might say, comes not only from the familiarity I have had with the area since high-school days, and acquired during hunting and fishing trips, but as representative of Ventura County on the Watershed-Fire Council of Southern California. I received my appointment from the board of supervisors in 1954. So, I have some knowledge not only of my own county but other counties of the State through visits to those areas and attendance at their county meetings.

We have in Ventura County 51 percent of our total land area within the Los Padres National Forest. The bulk of that land is brush covered, but there are some timbered areas, but it is all steep and quite rough and without roads or firebreaks in the greater portion of it.

We feel the watersheds are highly valuable, because within the principal streams there are presently 2 water projects producing and

1 under construction. The two producing projects were developed by local interests and financed locally, and the third, the one under construction, is a Bureau of Reclamation project administered by local people. The 3 reservoirs, 2 existing and the one that is being built, will conserve nearly 360,000 acre-feet of water and represent investment or cost of over $40 million.

The valley lands are highly productive farms, with cities and defense establishments, and the assessed valuation is $409,272,650, and the production from the farms and oilfields is nearly $250 million—all of this being dependent upon the water developed within our watersheds. There is presently no imported water available to the county.

And it is interesting, in the light of your question, Congressman Rhodes, that we have so unpredictable a water supply that surface distributions are not practical. We must utilize the conservation of the rainfall at the time it occurs and then percolate that into our underground for our water supply, which is dependent nearly entirely upon pump water.

Congressman Sisk, your question, with regard to control burning, prompts me to say that the water produced comes from the areas within the national forest and does not necessarily include very much of the low, less-steep lands that are not as erodible as the areas that produce the water. We have water occurring within the lowlands, but it is not economically feasible to conserve it.

We feel, because of this high value and because of the attraction of the reservoirs for recreational use, that we have a high use and high value, and, as a result, the incidence of fires increases.

All of this is evidence that has been given before, but I merely endeavor to emphasize it as indicative of the conditions that are unique for southern California and reach beyond Ventura County to the north.

We should not overlook the use of research in the control of these fires, for the reason that the planes—and I had occasion to witness their use in fires within our area—have been most effective. And that observation was made by those on the fireline.

So, we have the use of planes and helicopters, and it might well be developed through research that there would be a practical means of brush control, and, I suggest, perhaps chemical or some other means, mechanical means, rather than the use of fire as a tool.

I would like to think of the condition within our county, which is similar to other areas in the State where you have high use of high values, as requiring insurance, and, since we cannot secure insurance from companies, then let us provide it through a higher level of protection.

I have an additional suggestion, and that is perhaps the use of Armed Forces trainees within the national forests.

There is attached to the statement a paper which explains in more detail the suggestion, and it is based upon the use of the Seabees from the 2d Battalion Headquarters at Port Hueneme within the national forest at Rose Valley, where they presently have a camp available for 40 men. They are doing great work in building trails and roads and the relocation of roads, developing water supplies for fire-fighting equipment.

Incidentally, Congressman Teague and I presented this plan to the Defense Department and to the Forest Service officials in Washington in April, and the present attitude of the Defense Department is that it can be handled on a local basis, similar to the Los Padres construction by the 2d Battalion Headquarters at Port Hueneme, where the objective of the training program is to develop skills in the use of heavy equipment. Those boys can acquire those skills and produce constructive accomplishments and can be better trained, perhaps.

As I envision it, it would be in areas adjacent to training centers and not involve high additional expenditures, because the equipment is going to be used, the fuel is going to be consumed. The boys are going to be trained, and if that training can occur in productive work such as the Forest Service can utilize, then we will be better off because of it.

I would like to close, as far as my report is concerned, with the statement that my acquaintanceship with the men in the Forest Service, from the guards on up, indicates that they are dedicated and, in many instances, give of themselves more than civilians demand or expect.

I have a communication here from E. Domingo Hardison, a director of the State board of forestry, who was unable to attend but has a prepared statement which, with your permission I will read. I am not familiar with it.

The CHAIRMAN. Without objection, we will make it a part of the record and it can be handed around, Mr. Jewett, if that is agreeable.

Without objection, this statement will be made a part of the record along with Mr. Jewett's statement, and we will look it over.

(The statements by Mr. Hardison and Mr. Jewett follow:)

STATEMENT OF E. DOMINGO HARDISON

The national forests of the United States were dedicated by Congress to multiple public use in order of priority of importance. In southern California, the highest priority is for water production.

The United States Forest Service is charged with the protection and management of national-forest lands, be they timbered or brush covered. This they have done well, commensurate with the funds provided.

The protection and management of watersheds is one of great responsibility, one that cannot be taken lightly, and must not be subject to the whims of the moment or shortsighted actions of expediency and economy.

The disastrous fires of a year ago have prompted a congressional inquiry looking toward an improved solution of the problem.

It is anticipated that systematic, controlled burning, if such can be accomplished, will be among the suggested palliatives. We, who are interested in the protection of watersheds for sustained water production, are not interested in brush protection because it is brush but solely because brush affords the best protection to the soil mantle of any cover on our watersheds today. Under brush cover we have a stable condition with erosion equaling nature's production of new soil. Watersheds are healthy and produce a maximum flow of silt-free water over a long period of time. The sustained flow of clear water is most important in water conservation. Southern California is favored with some of the most extensive underground water basins known. Their capacity far exceeds the possible capacity of surface storage. These basins are covered with leaky roofs, that let water percolate in. Silty, muddy water seals the roofs, slows infiltration, and wastes water to the sea. Quick flash floods offer little opportunity for water penetration. Muddy water silts up our surface reservoirs, stealing away their capacity. Once filled, a reservoir site is lost forever.

Once the cover is destroyed by fire, erosion sets in, and the succeeding cover is less dense and vigorous than the original. One more fire and the snowball of watershed destruction is on the way.

The soil being bare, these methods of erosion become active: (1) Erosion by water; (2) erosion by wind; and (3) erosion by gravity. Water and gravity take silt and debris downstream, clogging stream channels and silting reservoirs.

Consider for a moment steps completed and underway to conserve water locally, and the magnitude of the attendant expenditures. Their success and length of life depend upon healthy watersheds to insure an adequate, silt- and debris-free water supply. Witness Santa Barbara's Gibraltar Dam—shortly after completion, fire destroyed the cover above the dam, and the very next winter nearly half of the capacity of that costly and sorely needed reservoir was lost forever due to siltation. Consider expenditures already made and currently underway to provide water needed locally and arising wholly in Los Padres National Forest.

1. United Water Conservation District of Ventura County has completed Santa Felicia Dam and appurtenant works, including spreading grounds and pipelines. The principal function of this project is conservation of water by storing water in underground basins for later pumping. This project was financed by a local bond issue in the amount of $10,939,000.

2. Santa Barbara has completed the Cachuma project, an expenditure in the magnitude of $36 million. This is a Bureau of Reclamation project.

3. The Ventura River Municipal Water District project is under construction; a $31 million Bureau of Reclamation project.

4. The Flood Control District of Ventura County, zone 1, built Matilija Dam, at a cost of $3,500,000 by direct taxation.

These projects, which total $81,439,000—not including Gibraltar Dam—are all on small independent watersheds, yet within a radius of 50 miles. The important point—each is dependent upon watersheds of Los Padres National Forest for its water supply.

These are the facts as I see them: There is no comparable area in the United States of such urban concentration, economic, agricultural, and industrial wealth that utilizes so completely and immediately the water, as soon as it reaches the valleys, that cascades out of its mile-high mountains. And, California can, if its present water rights to the Colorado are respected, become self-sufficient in its water supply. But this presumes that watersheds are kept healthy, in good condition, so that all means of storage can be fully utilized. There is no comparable area where a series of what might be called small fires, in small independent watersheds, can cause so much economic distress, even disaster, to such extreme concentrations of population, agriculture, and industry.

Fire has been a tool used by man in wild-land management since the dawn of history. Periodically, burning is pressed as a cure-all for all wild-land problems. Recently, Dr. Homer LeRoy Shantz, an internationally recognized authority on plant ecology, botany, plant geography, and plant physiology, completed a study of the available published material on fire as a tool in wild-land management. This included writings and observations beginning in the first century and continuing to the present time and from all the countries of the world. Some 377 separate sources of literature are cited. There is one common theme: Fire alone is not the answer. Far more permanent damage has been done than benefits derived. Succeeding generations of mankind have failed to learn from the disasterous failures of their predecessors.

Let us not make the same mistake at this time.

Due to inadequate financing, the Forest Service in our southern California national forests have inadequate access roads, insufficient modern equipment, insufficient numbers of heliports, no facilities for capturing storm waters for water supplies at strategic points, and inadequate initial-attack forces. We recognize and approve the additional funds of the past year. Already the improvement is being felt.

Emergency funds for campaign fires are seemingly unlimited, but sufficient support funds seem to be woefully lacking.

It seems irresponsible to permit the loss, by fire, of both timber and soil mantle in our water-surplus forested areas as well as in our water-deficient brush watersheds. It is mandatory that these lands be maintained in a healthy condition and not allowed to become sick watersheds.

Measured by State standards and State practices, the Federal Government, as custodian of our national-forest lands, is falling far short of meeting its fire-protection responsibilities.

STATEMENT OF F. R. JEWETT, VENTURA, CALIF.

Mr. Chairman, before presenting any statement of the problems of brush and forest fires in southern California, and the need for more adequate protection, I would like to identify myself.

I am a farmer, born in Ventura, and presently living on my farm near Montalvo. In November 1954, I was appointed by the Board of Supervisors of Ventura County to be the county's representative on the Watershed-Fire Council of Southern California. I serve without salary, receiving only my expenses while attending the necessary meetings. This I do gladly, since I feel it a good citizen's obligation. My familiarity with the area began with hunting and fishing trips into the back country while in my teens.

Meeting with other citizens from southern California and with representatives of the various fire-protection agencies in the area, at the council meetings, has given me some conception of the fire-protection problems peculiar to our brush and forest areas. Visits to the national forests have given me firsthand knowledge of the terrain to be protected and the facilities available for this protection.

Some counties in the State have State division of forestry personnel and equipment to protect the private lands of the unincorporated county. In Ventura, we have a county fire department with this responsibility, and the United States Forest Service to protect the land of the Los Padres National Forest. There is a splendid spirit of cooperation existing between these two agencies, with assistance given regardless of the origin of the fire. However, the needed level of protection in the national-forest lands can be the responsibility only of the Federal Government through its representative, the Forest Service.

The Los Padres National Forest represents 51 percent of the land area of our county. With some timber, the cover generally is brush, and the terrain is steep, rough, and dry, without roads, firebreaks, or trails through vast areas of the back country. The greater portion of all watersheds in the county are in national-forest lands. From these watersheds comes all our water supply. We presently depend almost entirely upon pumped water, and there is no water being imported into the county. There are now 2 completed water projects—1 on each of the 2 main streams. Another project is being built under a Bureau of Reclamation contract. These reservoirs will conserve nearly 360,000 acre-feet of water, with a cost of almost $40 million. The two completed projects were built with local moneys and under control and direction of local people. Additional projects are being planned by a local conservation district. We, therefore, consider our watershed valuable, with protection from fire necessary to insure the continued yield of every drop of recoverable water.

The valley lands are highly productive farms, producing agriculture products shipped across our Nation and even to foreign countries. Among these farms are cities and a growing urban development characteristic of southern California. We also have highly productive oilfields, and some vital defense establishments. Our economy is dependent upon the watersheds that produce our only water supply. The assessed valuation of the county is $409,272,650, and our farms and oilfields produced nearly $250 million of commodities and should be maintained for the good of us all. In addition to the loss of water following a fire, the flooding that so many times occurs might result in the loss of life and property.

The rapid population growth has placed a strain upon our existing recreational facilities. The lakes created by our dams seem to be a very great attraction, bringing people not only from the metropolitan area of Los Angeles, but from the inland valleys of the State. Evidence shows most forest and brush fires are caused by man; thus, the greater use by man increases the incident of fires.

In cities and urban areas, the higher use of an area with the increased value results in better protection being made available. With better protection available, the insurance companies reduce their rates for insurance. Since we cannot secure insurance policies on our wild lands, then the best insurance is to provide the necessary level of protection. An adequate force of qualified men, with the necessary equipment and with the roads and firebreaks that make possible an effective initial attack, should be able to contain fires that otherwise might become wildfires. These wildfires, or campaign fires, cost great sums to fight, and there can be no economizing then, but money spent in preplanning and presuppression work might well result in substantial savings in the long run.

Not to be discounted is the research that has given us the plane, for chemical and water drops, and the helicopter for laying hose, observation, and moving men. I have had occasion to observe the use of planes and to talk to men that have been on the fireline. We all agree that the planes are a valuable new tool. It may be possible to develop new techniques of fire fighting, or understanding of the behavior of fires. Brush control, by whatever means, might be a productive field for research also.

I am sure others will make similar statements, but one that cannot be overemphasized, and that is the unique combination of conditions peculiar to southern California. All these combine over several months of each year. Here we have rough, dry, inaccessible terrain covered with dense brush, that is highly inflammable during periods of heat and low humidity. We have a high public use of the back country, except those areas closed because of extreme conditions, and all this near a populous section with a high economic importance. These factors are not generally appreciated by people from other parts of the country, and even by some local citizens, but warrant special consideration by those with the authority to take corrective steps.

The attached paper explains the suggested use of Armed Forces trainees within the national forests. It describes how the trainee while learning the necessary skill in the use of heavy equipment like dozers and earth-moving equipment can build roads and firebreaks. The trainees could even improve water supplies for the fire-fighting equipment. There is a good example of the use of trainees in Los Padres National Forest, at Rose Valley, near Ojai, Calif. The Seabees from the Construction Battalion Center, Port Hueneme, Calif., have established a camp for about 40 men, and these trainees have made a substantial contribution to the presuppression facilities of that portion of the forest. Perhaps other trainees in training centers convenient to national forests could do some of their training on similar projects.

Reference was made to the closure of some portions of the national forests. In Ventura, the most hazardous and difficult to protect areas are closed from June until the first soaking rain in the fall or winter. The increased demand for recreational areas and the sportsmen who do not understand the need for closures must be considered too. Every practical effort should be used to make the greatest possible use, consistent with safety, of our national forests.

We citizens should feel very grateful for the dedicated men of the Forest Service. Those men that I have met, from the guards to the supervisors, are men giving of themselves service greater than is expected of those in civilian employment.

Thank you.

NATIONAL FOREST—TRAINING AREAS FOR ARMED FORCES

Prepared by Watershed-Fire Council of Southern California; Los Angeles County Watershed Commission; Tri-County Fire and Flood Prevention Association, San Bernardino, Riverside and Orange Counties; San Diego County Citizens Forestry Study Group; Los Padres Citizens Group; Santa Barbara, Ventura, and San Luis Obispo Counties: Military Equipment and Manpower Committee, F. R. Jewett, chairman, Ventura.

National forests represent natural resources of watersheds, timber-growing lands, and recreational uses that individual citizens should be obligated to protect for their high public value. However, as individuals, we look to the proper Federal agency for the responsibility for this protection.

The United States Forest Service is charged with this responsibility. Fire being the greatest menace to the wild lands of the national forest, their protection program includes prevention, detection, and suppression.

Let us consider some features of the prevention program. Hazard reduction is as important within the national forest wild lands as it is in our cities and homes. Since many forest areas are extremely arid over extended periods the danger of fire is extreme. One means of prevention then, is to provide the facilities to most effectively supress the fires that do occur. This is accomplished by fire breaks in the wildland cover, roads, and water supplies so the human forces can be effectively employed.

How can the Armed Forces assist in the prevention program of the United States Forest Service?

The Defense Department in its Armed Forces training program is developing skills in the trainee to enable him to meet any emergency. The advanced training of these trainees may well be developed while learning within the national

forest areas. More specifically, the engineers and heavy mechanized equipment operators, could produce substantial contributions in fire breaks, roads, and improved water supplies, while developing the necessary skills and thus augment the prevention phase of the United States Forest Service program.

The wildlands of the national forests provide unlimited areas of different terrain types and cover. A training program of the Armed Forces, integrated with the prevention plans of the Forest Service would provide maximum benefits to each department of our National Government. Specific projects, as outlined by the Forest Service, could be considered as military problems or maneuvers, and a task force of military personnel, employing officers, engineers, equipment operators, transportation and supply, in their solution or execution. The development of additional recreational areas, now overtaxed by the great increase in public use might serve as training opportunities for some other specific phases of the training program.

Fire suppression oftentimes requires the maximum use of all available men and equipment. The Armed Forces have never failed to respond when called, and have contributed invaluable assistance. There can be no economizing in fire suppression. Prevention, on the other hand, can, through coordinating the plans of the Forest Service and a training program, utilize the most ideal conditions to accomplish both good land use management and ideal training objectives.

Fire-denuded watersheds create flood conditions that result in loss of human life, extensive property damage, and destruction of water storage capacity of the water development projects within the forest and wild-land areas. Some water development projects are the only source of water for certain areas of our county. Their preservation is vital to the economy of these areas. The loss of valuable timber and wildlife are other consequences of extensive fires. Every effort should then be made to restrict and limit fire damage.

The Port Hueneme Construction Battalion of the United States Navy have in their advanced training program within the Los Padres National Forest provided evidence of the mutual benefits to be derived by such a plan.

Public support can be warranted by the productive "training while learning" of the Armed Forces trainees, and the skills so acquired will make the trainee even more acceptable to civilian employment when his Armed Forces service is completed. Any national forest area convenient to a training center could well provide further opportunities for this coordinated plan. The Forest Service program would be supplemented with this military activity and still not result in an increase in Defense Department training expenditures.

We would all be richer by the accomplishments possible.

The CHAIRMAN. Now we will get down to the questions.

Mr. Nicholas, you hit upon something I mentioned earlier today, and that is research for fire-resistant materials.

Mr. NICHOLAS. Yes, sir.

The CHAIRMAN. Were you talking about something to put along the highways so that if somebody threw out a match it would not set the world on fire?

Mr. NICHOLAS. Yes, sir. As far as the present time, the growth they are working on is brought from foreign countries that are fire resistant and have been tested along those lines, but they are not native to this country, and it is a question of research to go in to see whether they will be in that category and whether they will grow in this part of the country.

There is also the possibility of spraying. However, I do not know how far research has gone along that line. It has been purely an idea of spraying along the highways, that we spray along the highways to knock down the brush and get rid of it. If you just leave it grow back up again with the same type of material, all you have is a maintenance problem and maintenance can go so far. The first thing you get is that maintenance is costing you more than construction of something that is, say, a concrete wall alongside of the highway. I think there is a limit as to how far we can go on maintenance. I think some experimenting has to be done along that particular line.

The CHAIRMAN. I believe you testified also that some of these hills are so steep there is not any conceivable access to them. Is that right?

Mr. NICHOLAS. That is quite true in the area along here [indicating]. As I mentioned, here you have an elevation at the base of 1,500 feet and at the top of the crest here it is 6,000 feet, and it is purely a matter of about maybe a mile. So you have just a 45° angle here. That has to be treated by the use of the firebreaks they have had. The control of the McKinley burn and the control of the East Highlands fire has been only at major firebreaks they have had, in which they have gone far beyond where the fire was and cut a big firebreak through here. That is where the fire stopped and where they controlled it. But they do not have all of those firebreaks throughout all of the area.

It becomes a question of proceeding with the firebreaks, which we think certainly should be the case—going ahead with the building of more firebreaks, so in preplanning you do break it down into a smaller segment for control, getting along the ridge line.

However, I do think while that is going on, perhaps what we have to face today—I do think research should be accomplished to prevent this and not having every 20 years a complete area burning down, but having it as a controlled area for the future.

The CHAIRMAN. I certainly agree with you and agree with Mr. Silverwood regarding the importance of prevention, getting this thing done ahead of time.

I think, though, in some areas it just gets to the point, with the fire conditions down here, where apparently no amount of prevention would do a lot of good, because that fire will jump 5 or 10 miles.

Mr. NICHOLAS. I think the reason perhaps why I expressed that was whether we are making out in the other basins down here where we are taking out thousands upon thousands of yards of material and hauling it away, or whether that same tax dollar—whether the Federal Government is spending it or the local people spending it, it is still a tax dollar—and if we spend it up here in prevention it would eliminate the necessity of having to take the material away. We cannot stop the necessity for building flood-control structures, but we certainly can from a maintenance standpoint of thousands upon hundreds of thousands of yards of material that come down from the mountains.

The CHAIRMAN. The gentleman from California, Mr. Sisk.

Mr. SISK. No questions.

The CHAIRMAN. Mr. Rhodes.

Mr. RHODES. I just want to say, Mr. Jewett, I am very much interested in your idea to use the trainees in the Armed Forces to build some of these breaks. They have to be trained anyway, and we might just as well train them on something of value to the country.

Mr. JEWETT. May I make an additional observation on the use of trainees?

Mr. RHODES Yes.

Mr. JEWETT. Their experience acquired before was on the base where they made an excavation 1 day and filled it up the next.

The CHAIRMAN. At Camp Beale they would rather build a piece of road and then tear it up. They should have been up in the high mountainside building firebreaks or getting access roads, at least for limited access for fire purposes. It is a very sensible suggestion.

Mr. JEWETT. All indications are it is highly morale building to the trainee, as he is quite happy in seeing something productive.

The CHAIRMAN. Thank you, gentlemen, and the committee will stand in recess until 1:30 this afternoon.

(Whereupon, at 12:05 p. m., a recess was taken until 1:30 p. m., this same day.)

AFTERNOON SESSION

The CHAIRMAN. The subcommittee will be in order.

The next group of witnesses are local permittees and the users on the national-forest lands and public lands—Mr. Burton W. Bogardus, Adrian G. Wood, and Mr. Armen Sarafian.

Mr. Bogardus, will you sit down, please.

Do you other gentlemen want to come up? We will be glad to have your statements at this time.

It would be appreciated if you would give your full name, address, and in what capacity you are appearing before the committee.

STATEMENT OF BURTON W. BOGARDUS, PRESIDENT, BIG SANTA ANITA CANYON PERMITTEES' ASSOCIATION

Mr. BOGARDUS. Gentlemen, I represent over a hundred cabin owners who hold special-use permits in Big Santa Anita Canyon, north of Arcadia in Angeles Forest. Just as those who live at the seashore are the first to raise their voices against beach pollution, we in the forest have a vital interest in fire and all other forestry problems. For at one time there were over twice as many cabins in our canyon; fire and flood have wiped out over a hundred in the last two decades. To my knowledge, not a single fire has been caused by a cabin owner, some of whom have lived in the canyon since World War I. I'm sure I speak for all of us when I say that although we may have houses in the city, the canyon is our home.

Aside from the annual payment we send to the regional fiscal agent, our main contact with the Forestry Service is the canyon ranger. Down through the years we have seen many come and go; some of them high caliber, strong, intelligent dedicated men. But the turnover rate is tragic; for years the Forestry Service funds have been pitifully inadequate, and you cannot ask any competent man, however dedicated, to live indefinitely like a monk or hermit. And for the lack of a small full-time crew, firebreaks have become overgrown, trails have become impassable, campgrounds inadequately maintained, reforestation neglected, and trash and dry brush accumulate around public areas.

At 10 o'clock on the night of December 27, 1953, I stood on the road to Chantry Flats and watched one of the most horrible fires in the history of Angeles destroy my canyon. Dozens of wonderful fire engines with their crews stood idle and impotent along the road as the holocaust roared unchecked, and I saw far below through the smoke my homesite surrounded by flames. Perhaps a helicopter, a hotshot crew, or a few flying tankers could have checked that fire. I don't know. But I left the canyon feeling that my world had ended. Returning at daylight, I was vouched for and permitted to pass by our weary and begrimed canyon fireman, who had fought

all night. (He, too, was later compelled to leave the service for a more remunerative job.) The ridge where my trail goes in was still burning, but I remembered an alternative access trail built by the CCC still 20 years previously which lay in an unburned area. Fighting my way through the brush to the canyon bottom, I found my home still intact, but was just in time to start my water pump and extinguish a threatening fire a few feet away.

In the rugged terrain of many areas in Angeles, fire fighting is practically impossible; the entire program, therefore, is intimately related to a year-around prevention program. But this is not solely the responsibility of the Forest Service; it lies in the policy of the Government as a whole and the attitude of the people toward the forest. Although the admitted objective of the alphabetical agencies of the depression was to provide jobs, the work done by the Civilian Conservation Corps in the forest 20 years ago is still apparent in many localities, and remains as a reminder of the most effective program of fire prevention and conservation ever undertaken by our Government. And the trails, firebreaks, recreational areas and check dams built by these boys under the direction of forestry engineers were not the only beneficial results of this agency. Our young men put into uniform today and sent to some 70 foreign countries are thoroughly indoctrinated with information on what they are fighting against; but the boys in the CCC knew firsthand a vital part of the American heritage that is worth fighting for. Why cannot such an agency again be established? Could not those ineligible for military duties still perform a valuable national service in the forest?

It might appear that this committee is not the proper one to approach on this subject; but the fire problem is only one external symptom of a ravaging forest disease; namely, neglect. If the forest is to remain the birthright of the people, its overall welfare must be considered by those responsible for any phase of its administration. Those of us who have and will continue to invest our time and money, and our blood, sweat, and tears, earnestly request your best efforts on behalf of the forest, and pledge to you our continued support.

Gentlemen, I have a couple of pictures here, taken by helicopter, of the Dunsmore burn taken in 1955. They would bear out the testimony which you certainly had before.

I might compare the fire in the Angeles to a pregnancy—getting it started is one thing, and getting it stopped is something else.

We have these two pictures here, one of them looking toward the La Crescenta Valley from on top of the ridge, and the other one looking back toward the mountain.

Particularly, I think Mr. Sisk would be interested in this one here. It shows the ruggedness of the terrain immediately contiguous to our Pasadena-La Crescenta Valley area.

The other one illustrates very excellently the shotgun principle which Colonel Hedger of the flood control district pointed out yesterday. You are looking right down from the muzzle of the shotgun right at the La Crescenta area.

The only think I had further to say to you was in partial answer to questions which Mr. Rhodes and Mr. Saylor propounded yesterday, which I do not think were too well covered.

Mr. Rhodes spoke about the ground cover and questioned the use of various materials. I do not believe the seeding program of rye and mustard seed has been very much touched upon.

As a firsthand observer, I would like to compliment the Forest Service on that seeding program, because the activity was undertaken immediately after the Monrovia Peak burn which I mentioned, in which our canyon was literally seeded with both rye and mustard. While it did not prevent a considerable amount of erosion occurring on a hard rain about a month after the fire in January of 1954, still those green shoots prevented a great deal of further erosion later on in that season.

Mr. Saylor asked about building dams where the water falls. In our canyon at this time there is a survey now taking place to determine the feasibility of the construction of many small flood-control dams over the entire length of our watershed. At the present time the big flood-control dam at the mouth of the canyon is two-thirds full. About a third of it was filled in the 1938 flood, and about a third of it in January of 1954, which I mentioned. To remove that material, as I understand it, would cost about $6 million. To conduct the task of building the small flood-control dams, about a hundred of them, in the canyon would cost only a third as much, or about $2 million, and I understand that even this project now is in jeopardy because of the financial situation.

Gentlemen, I appreciate the opportunity to be here more than I can tell you, and I will be very happy to answer any questions, not as an expert but as one whose heart and soul is certainly in the forests.

Thank you.

The CHAIRMAN. Mr. Adrian G. Wood. Mr. Wood, do you have a prepared statement?

Mr. WOOD. Yes, sir.

The CHAIRMAN. It would be appreciated if you would fully identify yourself as to name and address, and for whom you speak, if any one other than yourself.

STATEMENT OF ADRIAN G. WOOD, CARPINTERIA, CALIF.

Mr. WOOD. Adrian G. Wood, Carpinteria, Calif. I speak principally as an interested lemon grower, but also for a sportsmen's organization of Santa Barbara.

The CHAIRMAN. Thank you very much.

Mr. WOOD. Mr. Chairman and assembled company, it is a sort of satisfaction to me that the committee has allotted me time to study a problem which has become acute. I am grateful for the opportunity to present my conclusion as to a solution.

Unless we can repeal the law of gravity we will experience erosion. Brush has always burned and probably always will. What would be the end result if it did not?

Without these combined natural forces, we would have no farmland. Fortunately, both erosion and fire are, and will continue to be, a part of nature's plan. Why not utilize them to our advantage instead of trying vainly to suppress them?

I have lived in this locality since 1892 and my ideas are founded on personal observation and experience.

Let it be understood that I am speaking only of an area with which I am familiar—coastal southern California. I am certain that no single formula of management can be applied to meet the varied conditions of the vast holdings of the United States Forest Service. I think we are agreed that the major problem of the great Southwest is water and its conservation for the needs of man. There is no waste of this commodity that should be allowed.

Any large vegetative growth which stays green during our dry summer is using vast quantities of water to stay green. In so doing a layer of earth is almost dried out to root depth. When rain comes it may take the total rainfall to replenish what has been used. This is not true of grasses and weeds which root not over 2 feet; nor of brush with limited foliage. Moist earth permits the passage of water to lower levels. Dry earth absorbs it. Examples are available.

Important to citrus growers whose orchards are adjacent to brushlands is the menace of a gigantic forest fire, which we of Carpinteria know from experience (1917) almost ruined a season's crop of walnuts and beans. Lemons, now our principal crop, would probably fare worse.

I believe the present policy enhances the recurrence of dangerous and uncontrollable outbreaks of fire. The ever-present threat of conflagration is growing rather than lessening. Control of major mountain fires has never been effective and has always been costly, even of human life.

Our present system of "no fires" in practice has resulted in periods of calm followed by serious and far-reaching conflagrations. So again the question is raised. Are we wise in attempting to maintain an apparently impossible and probably undesirable condition?

Before the Forest Service assumed the management of this area, cattlemen in the fall of each year, burned on days of normal temperature, humidity and wind, any stand of brush which appeared dense enough to burn. This practice assured cattle feed the following spring. As I remember this era, erosion was not excessive, streams were clear, springs productive, and game abundant.

It is, or was, common knowledge that the Indians, to preserve adequate water supplies and maintain abundant game herds, burned annually their forage and hunting lands. With the advanced knowledge and scientific research at our command, it seems incredible that our results do not equal theirs in efficient forest management.

I see there are a lot of people here today. I am going to say one more thing to go with my text, and that is I believe the remedy is in a long-time program of brush burning under favorable conditions by experienced men.

Thank you.

(The statement submitted by Mr. Wood follows:)

STATEMENT OF ADRIAN G. WOOD ON THE PROTECTION AGAINST FOREST AND BRUSH FIRES IN SOUTHERN CALIFORNIA AS SUBMITTED TO THE SPECIAL SUBCOMMITTEE OF THE HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

In presenting recommendations for control of brush by burning, I have in mind no such wholesale destruction as we witness after a fire sweeps over thick brush on days of 100° or more temperature, high wind and near zero humidity; but these are the conditions under which most of our major mountain fires occur. Large areas are left bare of everything except burned earth and ashes which

will probably be washed into streamlands and form a seal over which water will glide and with the result there is little percolation.

If brush is protected a sufficient length of time under reasonable growing conditions, its fate has usually been proven to be fire. In extreme weather conditions no human agency is required to start a fire, as a quartz crystal, piece of glass, or bright tin will suffice. Then "control" is a word without meaning. This is probably just as well, since mountain brush growth when it reaches a certain size and density ceases to be an agent of, but becomes a menace to, the conservation of water in proportion to the amount it uses.

In winters of heavy rainfall, unchecked growth is often the cause of earth slides because it holds back too great a weight of water. These slides temporarily dam streams and as they break and reform, destruction is multiplied. An example was furnished by the Ventura River in 1914.

In any brush covered mountains I believe the answer to our control problem is to start fires on afternoons of fall days of reasonable temperature and humidity. The brush will burn no longer than the southwest trade winds blow, which presumes that not too great an area will be burned at one time. If it restarts the next day, so much the better, as it will simply increase the burned area. A scattered burning of this nature would create efficient fire breaks and another year remaining brush could be burned without denuding too great an area at one time. Not a 1-year endeavor, but a systematic, annual program should be inaugurated to hold mountain growth below the point of excessive water use and prevent devastating fires, now a periodic certainty. Brush roots would survive fires of this nature, use little water, and hold the soil in place. New growth from the stumps is ideal brouse for dear.

It is pleasant to visualize the slogan "Keep California green," but we do not have either the water or weather to afford this luxury. Summed up, it appears that after over 50 years of attempted control, the balance is on the wrong side of the ledger. It has been excessively expensive and is becoming more so. Let's return to that practice where a few boxes of matches and good sound judgment kept our mountains in good shape.

The CHAIRMAN. Thank you, Mr. Wood.

Has Mr. Sarafian arrived?

Since he has not, we will address such questions as we have to you and Mr. Bogardus first.

Do you have some questions, Mr. Sisk?

Mr. SISK. Just very short, Mr. Chairman.

Mr. Bogardus, as I understand your testimony, you are simply saying you feel that such additional moneys as we may appropriate should be spent in cleaning up the forest and doing the things that would prevent the necessity of ever fighting a fire. Is that generally your position?

Mr. WOOD. I did not hear. Was that addressed to me?

Mr. SISK. To Mr. Bogardus.

Mr. BOGARDUS. We should certainly have a large percentage of that money devoted to that particular service. I might add that, judging from past experience, the Forest Service funds have rarely been adequate to maintain the forest in such a condition that even removable fire hazards were out of the way. I particularly refer to public campground areas.

Mr. SISK. I think your comments were very pertinent on the CCC program. I know in some of our areas that is all the work that has ever been done in the forests.

Mr. BOGARDUS. Yes, sir.

Mr. SISK. In some cases we still see the beneficial results of that work.

Mr. BOGARDUS. Yes.

Mr. SISK. Mr. Wood, I might say, of course, I have been advocating some of the things you advocate in your statement, and I am very happy to hear your statement.

Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Bogardus, I notice you say here that, "Dozens of wonderful fire engines with their crews stood idle and impotent along the road as the holocaust roared unchecked."

Mr. BOGARDUS. Yes, sir. In my particular canyon, the road to Chantry Flats goes high on the hillside along the edge of the canyon to a dead end at the public campground. The fire was burning over across the canyon and down the lower side of the same canyon. They were not anywhere near the flames. There were no means to get the equipment in.

I might add that there again it was wonderful cooperation of the various agencies, because those fire engines belonged to many different municipalities as well as the Forest Service. But nevertheless they were not able to get at the flames, and when the flames hit the road they simply had to move out.

The CHAIRMAN. Do you agree with Mr. Rogers, who testified this morning that in some of those areas you could not get an access road because the terrain is so steep it would roll a bulldozer end over end?

Mr. BOGARDUS. In many areas that is true, yes, sir. As far as the heavy equipment is concerned, it is very difficult to move it. That is why I feel so very strongly that these small crews working on a year-around basis are much more effective than trying to get heavy equipment in after the fire has started.

The CHAIRMAN. I certainly agree with you about the necessity of preventive work of one kind or another. I agree with Mr. Wood, also, except I think in some of these areas we have terrain problems that make burning a very ticklish business, which has to be carried on very carefully.

Mr. WOOD. That is why I suggested experienced personnel. We have no business having just somebody go out and throwing matches in the brush. But a person who is familiar with the forest and knows when it will burn and will not burn excessively, I think, could create the finest firebreaks imaginable without serious damage.

The CHAIRMAN. I have a feeling there has been a doctrinaire attitude in the Forest Service about this, that they just do not believe in burning anything—until a fire comes along they cannot stop, and then they clear out and back up to the nearest ridge, or the farthest one.

Mr. WOOD. I agree with you perfectly.

The CHAIRMAN. So I think there could have been a good deal more flexibility on their part with reference to the management of this problem. It is significant that the State of California has burned over a million acres, with varying results, of course, but the Forest Service burned 40,000. That is like saying they harvested one straw out of a haystack. They have not done anything for practical purposes, although I agree that the program has its difficulties in the failure of the Forest Service to be imaginative, progressive, and aggressive in the field of fire prevention. If the Forest Service had been half as good preventing fires as they have been fighting fires, they would not have had to fight so many fires.

Now, that is my speech for this tour.

Thank you, gentlemen, very much.

Mr. BOGARDUS. In defense of the Forest Service—I was a little rough on them in my statement, and what you say has a great deal of truth

in it—but they have been remarkable, in considering what they have done with the funds they have had.

That is why I wanted to bring that picture in, because it shows why they are hesitant about the control burning thing. There is no place you can stand in my canyon and light a match, from where my cabin is 1,500 feet to the television transmitters on top of Mount Wilson. It goes up 45°. I would hate to be above or below a control burn in my particular area. That I am sure is the reason the Forest Service has been reluctant to experiment on this type of terrain.

The CHAIRMAN. We flew over it, and I am certainly aware of that. As I told Mr. Wood, I think the matter of burning has to be handled by experts and people who know their business.

Thank you, gentlemen, very much for your testimony.

I understand Mr. Sarafian is not here yet.

We have a group here from the conservation groups of one kind or another. Mr. Lloyd P. Parratt. Mr. Parratt, we will be glad to hear you, and it will be appreciated if you would identify yourself fully as to your address and whom you represent in addition to yourself, if anyone.

STATEMENT OF LLOYD P. PARRATT, PRESIDENT, POMONA VALLEY AUDUBON SOCIETY

Mr. PARRATT. Chairman Engle and members of the committee, I am representing officially the Pomona Valley Audubon Society, although I must say that if it were not for the cooperation of Chaffey College I would not be here. In other words, they made it possible for me to be here during the day.

The CHAIRMAN. Will you convey to them our appreciation? We are glad they did.

Mr. PARRATT. I certainly shall.

I should like to say, in connection with the Chaffey College, we do have a reforestation program in San Antonio Canyon, which started after the disastrous Bear Canyon fire, and that the students who have participated in planting trees have a real respect for the dangers of fire. I certainly agree with the testimony that has preceded that we need to have much emphasis on education as a preventive factor.

I have the feeling that our greatest weapon may be in the field of education rather than in the making of laws to prevent many of these forest fires.

Speaking with reference to a statement I believe compared the burning of chaparral to a skilled surgeon removing the appendix, I would like to say, from the standpoint of a biologist, that the appendix is a vestigial organ; it no longer has any function. And I hardly think we can compare chaparral to that organ. I would rather say we should compare it with the heart.

The CHAIRMAN. That was Mr. Fenner. You will have to discuss that with him.

Go right ahead. You are making a good point.

Mr. PARRATT. I sincerely hope that much good may come in a constructive way from this investigation. I have had much personal contact with the Forest Service men, and I have found them highly competent, sincere, and dedicated.

Studies that have been made by various institutions, including the California Institute of Technology, reveal there is no cover comparable in value to the brush which we ordinarily call chaparral, that it is the best medium for protection of mountain sides from erosion, encouragement of water percolation, and inhibition of floods which has yet been found.

Certainly I believe it would be agreed that floods have caused much more loss of life than have forest fires. I think it is very important that we have more respect for the chaparral, which is the native cover, which does fit in with the natural cycle of nature here.

Furthermore, I am a little bit frightened by the lack of appreciation for the fact that soil is a living dynamic thing, and that when you burn you destroy much of the life in that soil and the wildlife which is dependent upon that plant cover.

The CHAIRMAN. I asked about that the other day, and they said that all we destroyed was the permeability, that is, the penetrating quality. Does burning destroy something else?

Mr. PARRATT. It takes a good many years, as we have pointed out, for that vegetation to come back to its desirable condition again. Likewise, it takes a good many years for all of these other factors to come back—the associated wildlife, the associated organisms in the soil, and so on.

I think our situation certainly has been brought out as being unique in southern California, where water is more precious than gold. I certainly will not dwell on that longer since it has been brought out previously.

But in the protection of our watersheds, I cannot conceive of any value coming from burning of the most valuable watershed plants that we know.

I believe that is all I have, gentlemen.

The CHAIRMAN. Thank you, Mr. Parratt.

(Mr. Parratt's prepared statement follows:)

CHAFFEY COLLEGE,
Ontario, Calif., October 1, 1957.

SUBCOMMITTEE OF THE HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Courtroom No. 9, United States Post Office and Courthouse Building, Los Angeles, Calif.

GENTLEMEN: The hearings on Forest Service responsibilities for protection against forest and brush fires is of life-and-death interest to us in southern California.

The majority opinion, apparently, in southern California is that during fire crises in the mountains, at least, the officials of the Forest Service are perhaps the most important members of our community. It is hoped that the immense amount of evidence which indicates the high qualifications, the enlightened public service, and the dedicated loyalty of this important part of our great Federal Department of Agriculture may be brought forward at the hearings.

Obviously, fighting fires is one of the most dangerous of activities, especially where the mountains are steep-sided and the air currents unpredictable. But without the protection of our mountains from fires truly catastrophic losses of property, land, and life through torrential floods would be inevitable. Up to this date, at least, losses of life from floods have been much greater, in this area, than those from fighting fires.

The studies of the mountains by competent scientific authority (California Institute of Technology, e. g., in cooperation with the Forest Service) seem to show that, under the peculiar and unique conditions prevailing here in southern California the brush (ordinarily called chaparral) is the best medium for protection of the mountainsides from erosion, encouragement of water percolation, and inhibition of floods, which has yet been found. Increased danger from fire

due to protection of brush is apparently one of those calculated risks which are pretty well justified. For without our brush, under our conditions here, as demonstrated by many burned areas in recent years, soil erosion from the hill slopes might increase as much as 100 times, floods would be much more disastrous, and much more of the runoff would reach the sea than does with the brush present.

It's true we haven't the whole story on any of this. The Forest Service and other agencies are diligently studying the situation with a view of perfecting our management practices. But with all information now in hand, any measure which would handicap the United States Forest Service in its efforts to protect us here in the Los Angeles and southern California area, would pose a serious threat to our property and our lives. In fact, we have felt, all along, that far more generous appropriations should be made by Congress to enable the Forest Service to protect us more adequately.

Attached please find a complete statement by Dr. Walter P. Taylor, chairman of our conservation committee.

Respectfully yours,

LLOYD P. PARRATT,
President, Pomona Valley Audubon Society.

SUBCOMMITTEE OF THE HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Courtroom No. 9, United States Post Office and Courthouse Building, Los Angeles, Calif.

GENTLEMEN: The hearing on Forest Service responsibilities for protection against forest and brush fires in southern California, October 8 and 9, 1957, is noted.

We of the Pomona Valley Audubon Society express the thinking of our conservation committee in this statement.

Our authority for this material is Dr. Walter P. Taylor, well known in the fields of ecology and conservation education. He was senior biologist with the Fish and Wildlife Service, United States Department of Agriculture. He is now distinguished visiting professor of zoology at South University, Illinois State.

Such an investigation may do some good. It will probably show that, under the conditions obtaining in southern California, no known grass, nor any known herb, can take the place of the chaparral community of vegetation as a protector of our mountainsides, preventer of soil erosion and floods, and promoter of water percolation into our subterranean reservoirs. Also that the United States Forest Service is following the one best policy, for this area at this time, in protecting, to the best of its ability, the brush on our steep slopes.

As you know, the chaparral community is made up of a number of tough evergreen plants which are peculiarly suited to a climate which is too cold in winter and too dry in summer to encourage growth. These chaparral plants are of such a character that they must utilize for growth those relatively short periods in spring, fall, or rarely, at other times of year, when there is enough moisture and heat (at the same time) to permit plant life to develop. Up to this date, according to our information, no grass or other plant can successfully compete with our present chaparral in this regard.

In southern California it is reported that we produce about 2 to 4 pecent of the State's supply of water; but we have approximately half of the State's population. Hence our intense and even life-and-death interest in the protection of our mountains so they may produce the most water.

To us water is more precious than gold. Even yet, nearly or quite one-half the water we use for domestic purposes, irrigation, and industry comes from our local mountains. On our water supply in Los Angeles County alone are dependent the values of personal property, salaries, wages, and income from investments in excess of $18 billion. This is a conservative estimate, based on assessed valuations and statistics for 1949 and 1950 collected by the chamber of commerce.

But while water, in southern California, is more precious than gold, it may also be more destructive than dynamite. Repeatedly floods in this area have created havoc, destroyed extensive property values, and taken many more lives (a far greater number, by the way) than have been lost in fighting our forest fires. In many, if not most, instances, the destructive floods have resulted from the removal of brush from the watersheds by fire.

We know that if watersheds demanded of brush were the answer to our soil and water conservation problems the case could have been proved long before this, as we have an increasing acreage of barren, debrushed, watershed in our

front ranges. But, far from being beneficial, these denuded watersheds exhibit accelerated erosion of soil, overrapid runoff of water with often a sealing up of surface soil layers so that there is decreased percolation of water into spring sources and underground reservoirs. Indeed, San Bernardino and many others of our southern California cities, especially those lying at the base of the mountains are becoming increasingly concerned. The destruction resultant from the big floods that come at intervals is appalling, as those who were residents in these parts in 1938 well remember.

The case with chaparral and watershed is quite different in your northern California country then with us in southern California. Our steep slopes, friable, erodible soil, and torrential, semiarid type rainfall, create special conditions. Consequently, with us, the chaparral seems to answer better the year-round need for protection and stabilized water production than any known grass or other type of vegetation. As you know this is true also in a few other parts of the world with a so-called Mediterranean climate, including the Mediterranean area itself, parts of South Africa, certain areas in Chile, and portions of Australia.

It is highly unfortunate—for us in southern California—that some of the livestock men, farm technicians, and others, whose experience largely has been on pasturelands of gentle slope, and usually with greater rainfall than ours, have come to rather dogmatic conclusions regarding the universal desirability of the replacement of brush with grass. If this replacement ever takes place in the brushy Upper Sonoran life some of our mountains in southern California, our entire economy, from the mountains to the sea, will be affected, seemingly very much for the worse, and our communities, starving for water, and wracked from time to time by painful and destructive floods, from the denuded steep slopes, will be altered into something quite different from what they are now.

From a period of observation extending more than 40 years, I have been impressed with the increasingly aggressive efforts of the organized livestock grazing interests to hamstring the United States Forest Service. You will recall that the 83d Congress decisively repudiated these efforts by rejecting the D'Ewart bill and the Hope-Thye-Aiken substitute or rather subterfuge which was introduced as a rider on an appropriation bill in a rather devious attempt to achieve at least some of the results aimed at by the D'Ewart bill.

From Julius Klein's book on the Mesta (organized woolgrowers) you will remember what happened to Spain. Between A. D. 1200 and A. D. 1800, these grazing interests operated under the patronage of the royal family and exercised prior rights in land use. Spain was virtually pauperized as a result of the resultant overgrazing, and is still one of the two most poverty-stricken countries in Europe. Parts of our own Southwest, notably the Rio Grande Valley in New Mexico, have been virtually ruined by the same vested interests.

In my observation, the Forest Service personnel constitute as honest, sincere, and dedicated a body of public servants as any in existence.

We also attach a copy of our letter to Hon. Clair Engle of January 31, 1957.

Sincerely yours,

Lloyd P. Paratt
LLOYD PARRATT,
President, Pomona Valley Audubon Society.

The CHAIRMAN. Is Mr. Harry T. Hall here?

(No response.)

The CHAIRMAN. Is Mr. Roberts here?

Some of these people, I assume, finally gave up. Most of my committee has. When I was in Blythe I had 13 Members of Congress, including one Senator. There are two of us left. I think Mr. Rhodes will be back directly.

Mr. Roberts, do you have a prepared statement?

Mr. ROBERTS. I sure do. I have memorabilia here by the score.

The CHAIRMAN. That is fine. It would be appreciated if you would identify yourself, your full name, address, and whom you represent other than yourself, if any one.

STATEMENT OF EARL ROBERTS, COCHAIRMAN, CITIZENS FORESTRY STUDY GROUP OF SAN DIEGO COUNTY, CALIF.

Mr. ROBERTS. My name is Earl Roberts. I am a cattle rancher in San Diego County, cochairman of the San Diego County Citizens Forestry Study Group, California Cattlemen's Association permittee in the Cleveland National Forest, and other organizations.

Mr. Chairman, my remarks will be brief, to the point, and are covered in detail in the report which I have submitted.

This happens to be my second appearance before your committee, sir. I appeared before you in 1950 under somewhat similar circumstances in the Chamber of Commerce Building in San Diego when you investigated the Conejos fire. At that time I was a cattle rancher in the Cleveland National Forest and was one of the ranchers whose property was threatened by this fire.

I testified at that time, and I repeat to say that any number of the recommendations I have are the same ones I made at that time. I do not know how many times we have to make these, but maybe if we have these hearings often enough and can go over the same ground enough times, we may get some of these things done.

You will recall, Mr. Engle, at the time of the hearing on the Conejos, Mr. Hamilton K. Pyles, who was then supervisor of the Cleveland National Forest, was asked by your committee for any recommendations he might have, after most of the people who were complaining about the fire had had their say. At that time Mr. Pyles said that he thought perhaps the most important thing to come out of a hearing was the necessity to place the Cleveland National Forest on a 12-month fire season.

The CHAIRMAN. Yes.

Mr. ROBERTS. I am glad you do remember that, sir. That has never been done. We still feel that that is a prime requisite to controlling the fires in San Diego County.

I have attended, and been on the ground at every major fire since the Conejos in San Diego and have made a study of these fires. Being a rancher, I am vitally interested in controlling these fires, because my ranch is located in the heart of the forest.

At that time, we felt that the Congress would do something about placing Cleveland National Forest on a 12-month fire season.

Two years ago I appeared before the Senate Committee on Appropriations in Washington, Chairman Hayden presiding, and at that time we were after an additional appropriation for the Cleveland National Forest so that we could maintain it on a 12-month fire season basis. The day I appeared, it was raining, it was cold, it was miserable. I was glad I was not a Congressman living in Washington and was very anxious to get back to San Diego. But the thing that impressed Chairman Hayden at the time, and other members of the committee, and perhaps one of the reasons we got our appropriation—at the very time I was appearing back here in Washington the State and Federal forestry officials were fighting a 500-acre blaze in San Diego County. They were quite impressed at that time by the fact that, with weather the way it was throughout most of the United States, we were fighting fire in San Diego County.

I would like to bring to your attention one of the reasons it seems very difficult for us in San Diego to sell our fire season to people out-

side San Diego County. Cleveland National Forest is unlike almost any other forest in the country, in that we have a very, very short wet season. We had about 9 inches of rain there last summer in San Diego, in the city proper, so you can appreciate we do not get very much rainfall.

The second point I would like to make, and one which I think has been covered in detail here today, is that with reference to the classification and the salary of the employees of the United States Forest Service. We talk about belling this cat regularly—this particular field of endeavor. This particular problem can only be solved by the Federal Government. There is not much point in citizens discussing this matter with Federal officials unless people who are in the lawmaking legislative branch of the Government are willing to do something about upgrading the people in the classification area of the United States Forest Service.

I have witnessed many, many instances and have many, many acquaintances who have been indoctrinated into the United States Forest Service. They serve a year or two, they get a little experience under their belt, and they are immediately pirated by one of these protection districts or other agencies of fire suppression, not the least of which is the United States Navy. We have the fire departments in every naval station in our area. The minute the Forest Service trains these young fellows and they have gotten a couple of years experience so they can qualify to take a civil-service examination, they are pirated away by other agencies of Government, not only Federal Government but State government and fire districts.

We have nineteen of these districts that have recently been formed in San Diego County.

So when you have to man 19 new fire districts, plus each of the various military installations within the county, you can readily see that there are several hundreds of men in the fire-fighting category of the various agencies of Government.

I think if there is some way in which you can upgrade these people so that the United States Forest Service, as such, becomes more attractive to the people in it, we will then be able to keep better men in the Forest Service.

Another area that I would like to discuss, and one that I think perhaps Mr. Rhodes is familiar with, is the matter of prison labor. I have had the privilege of going on a trip to Mount Lemmon, and I have viewed their operations over there for several days. I think that the United States Government is overlooking a bet in not doing something with prison labor in the way of forestry camps.

I would like to leave with you today a report of the Senate Interim Committee on Natural Resources of a study made on prison labor in forestry camps in the State of California. It is the most comprehensive report I have read. It was quite some 2 years in the making, and I will not bore you with its details, because there are some 62 pages, but I would like to read you about 50 words out of this which I think might stimulate your interest in reading the report. This is from the conclusion:

> The honor camp program, as such, is an excellent one. There is virtually an unlimited field of work. Neither the present honor camp activities nor those proposed for the future are competitive with free labor. The camps alleviate overcrowded conditions in the institution, they reduce inmate idleness, and

provide a practical and effective rehabilitation program to constructive work. On a per capita basis—

I am a taxpayer, gentlemen, just like you fellows—

On a per capita basis the cost of constructing the present type of honor camp is approximately half that of that necessary to construct an institution.

In the last session of the Congress, Mr. Bennett made a request for an additional Federal institution. I submit to you, gentlemen, that if it is necessary to increase the facilities of the Federal institutions, where you now have approximately 20,000 Federal prisoners, it might be well worthwhile to consider the creation of a few honor camps for the minimum security Federal prisoners in lieu of another institution.

I am not quite sure of my figures, but it seems to me that the cost per bed of a cell for a maximum security prisoner runs about $3,000 per prisoner as against about $1,200 for a minimum security.

The division of forestry, the department of correction, the California youth authorities, the division of highways—

and I want to call your particular attention to this in view of some remarks made here today—

and the United States service are to be highly commended, for it is through their excellent cooperation—

and I would like to repeat—

cooperation that California is placed in the position of being one of the recognized leaders in the inmate honor camp program. Further use of honor camp inmates in wards should be made on Federal and private lands when the overall interest of the State and the Federal Government is involved.

I would like to leave this with you, Mr. Engle, and suggest that if the other members of the committee would like copies—that is the only one I happen to have—I am sure the State forester, Mr. Raymond, could arrange for you to get a supply of these reports. But it is a very comprehensive report, and I feel it is very constructive and along the lines of the answer you gentlemen are looking for.

The CHAIRMAN. Thank you very much, Mr. Roberts, for that excellent statement.

If you will remain where you are, we will call Mr. Sarafian, who has just arrived, and then we will ask you gentlemen questions en bloc.

(The prepared statement submitted by Mr. Roberts follows:)

STATEMENT OF EARL ROBERTS

I am Earl Roberts, cochairman of the Citizens Forestry Study Group of San Diego County.

ORIGIN AND COMPOSITION OF THE FORESTRY STUDY GROUP

Our group was formed as a result of the Conejos and other disastrous forest fires in 1950. The group has met monthly without interruption for the past 6 years. In addition, it schedules several field trips each year to make on-the-ground examinations of specific watershed problems and fire prevention and protection proposals. The group is composed of a central committee representing all the interests of San Diego County which are dependent on the watersheds. In addition, 27 subcommittees represent each homogeneous land area in the county. It is the purpose of our group to prevent the recurrence of the catastrophe of 1950 when 85,000 acres of our valuable brush and timberland was blackened, 24 houses burned, and our watershed damaged, a total loss of $3⅓ million.

WHAT 6 YEARS HAS TAUGHT THE FORESTRY GROUP

Our group has learned the worth of an unburned, valuable watershed in supplying water for domestic, industrial, agricultural, and recreational uses for a county whose coastal region is desertlike and in the need of water, and whose population has increased an average of 75 percent every decade since 1900. We have learned that denuded watersheds waste our mountain soils, clog our streams, fill our costly reservoirs with debris, and threaten our farms and communities with flood and erosion.

The selection of San Diego County as a center for many large military establishments and for extensive aircraft production has caused us to recognize that the condition and use of our natural resources, particularly our water, is an important part of the Nation's strength and well-being.

The importance of our watershed is further manifest in the dollar value of agricultural production in our county, which in 1956 was valued at $93,241,000. That placed San Diego County about 17th among the 3,000 counties of the United States. You will understand, I am sure, the dependence of our county's agriculture on good watersheds when you note that we have formed more soil conservation districts than any other county in the United States, and for the purpose of maintaining agriculture without impairing our soil and water. We have made extensive use of agricultural conservation practices to further enhance the value of our watersheds. We are now looking toward the Watershed Protection and Flood Prevention Act as a means for more complete programs on a cooperative basis.

OUR GROUPS INTERESTS AND ACTIVITIES ARE COUNTYWIDE

We desire to point out that the studies and activities of our group are not confined solely to the Cleveland National Forest. Although the Cleveland includes the higher producing watersheds of the county, it presents only a part of the total watershed protection problem we face. Our interest is directed to all the watersheds of productive capacity and we look toward all people and agencies, private, community, city, county, State, and Federal, to meet their responsibilities and assume their proper share of prevention and protection. I now desire to inform you in considerable detail how local agencies are now participating in the overall job of watershed protection and fire prevention both inside and outside the Cleveland National Forest.

SAN DIEGO CITY'S CONTRIBUTION TO THE PROGRAM

For the year beginning July 1, 1956, the city of San Diego contributed $5,940 to the Cleveland National Forest. The fund is used to augment national forest protection in the vicinity of 7 city water reservoirs, 3 located within the boundaries of the Cleveland and 4 outside. Prior to 1956 the city allocated $3,240 annually, but increased the amount, almost doubling it to compensate for the rise in salary costs occurring in recent years.

SAN DIEGO COUNTY'S CONTRIBUTION TO THE PROGRAM

Since 1948, the county of San Diego has allotted $8,000 annually to the Cleveland National Forest. According to the agreement, this amount evidences part of the county's desire to help the national forests. Most of the forest is highly flammable and is closed to entry during the most hazardous part of the fire season. By opening a large part of the forest in San Diego County for recreational use, more intensive fire protection is necessary. The county recognizes this additional risk and hazard by funds, county ordinances, and construction of fire-protection facilities.

SAN DIEGO COUNTY'S ANNUAL APPROPRIATION TO THE CALIFORNIA DIVISION OF FORESTRY

An annual cooperative agreement between San Diego County and the California Division of Forestry provides for the county to reimburse the State for various costs incurred in forest fire and watershed protection in areas of county responsibility. The agreement specifies that the county appropriation each year is supplementary to a larger amount appropriated by the State for the same purpose in areas of State responsibility.

The amounts reimbursed by the county are for certain specified State expenditures for salaries, supplies, services, and administrative costs—principally for salaries. In addition to the reimbursement, the county budget has regularly included direct expenditures for additional supplies, services, and equipment for fire protection.

Since fiscal year 1948–49 San Diego County appropriations to the California Division of Forestry have averaged $100,000 annually. For the fiscal year 1956–57 the appropriation amounted to $112,383.

SAN DIEGO COUNTY'S CONTRIBUTION TO FOREST-FIRE PREVENTION AND CONSERVATION

Since 1951 when the Citizens Forestry Study Group of San Diego County was first organized it has promoted an extensive forest-fire prevention and conservation program involving the cooperation of community, county, State, and Federal Governments.

Beginning in 1952 the County of San Diego has contributed an average of $15,000 annually as its share in the cost of constructing firebreaks, roadside fire hazard reduction and similar forest and brush fire and conservation projects. The 6-year total appropriation to date, $90,000, has been supplemented by the State division of forestry and the Cleveland National Forest in planning, procurement, supervision, and inspection of these cooperative projects. In addition to the cash outlay of $15,000 per year the county has provided an average of 22.2 man-days per working day of county honor camp labor, valued on the basis of $8 per 8-hour day, at an annual total of $46,220. Between July 1952, and February 1957, the startling figure of 31,775 man-days of honor camp labor was contributed by the county to these projects. This does not include any time spent in the actual suppression of fires, but is all fire prevention or construction type of work. Thus, $90,000 of county money and honor camp labor valued at $254,200 has been the county's very considerable contribution to our forest-fire prevention and conservation program.

The combination of county, State, and Federal funds and men has made possible the following major fire-prevention projects. Some of these projects are nearing completion. All require continuing maintenance in order to remain effective.

1. A 300-foot wide firebreak extending 52 miles from east to west across San Diego County closely paralleling the international border between Baja California in Mexico and California.

In the decade of 1940–50 some 36 fires originating in Baja California penetrated several miles northward into San Diego County and ravaged 105,400 acres of San Diego lands bringing inestimable damage to watershed and recreational lands and private holdings.

To date, some 35 of the 52 miles of the international border firebreak have been completed. Two large segments have received initial maintenance. At least three fires originating in Baja California have been effectively stopped by the international border firebreak.

It is most certain that this firebreak costing $72,000 when completed (including $40,000 in State honor camp labor) will minimize, if not entirely eliminate fires entering from Baja California and consequently materially reduce or wipe out the devastation and suppression costs involved.

2. Similar firebreaks are planned and under construction along the east and west sides of the high mountainous areas of the eastern portion of San Diego County constituting the watersheds which provide the major source of our county's local water supply.

The Julian-Sunrise Highway 300-foot firebreak, a joint county and State project, has already been most effective in stopping small forest fires with terrific potentialities. Likewise, a western firebreak extending north from Highway No. 80 to Julian has been highly useful in controlling forest fires, even contributing much to the curtailment of the recent and tragic Inaja Forest fire.

3. A firebreak almost completely surrounding Palomar Mountain will soon be finished as a result of county and Federal financing. This break will not only protect the immense watershed, recreational and scenic values of world famous Palomar Mountain, but also, in a remarkable addition, will make possible the continuing use of the world renowned and highly valuable observatory in its most significant research. Should the ground cover of the area surrounding the observatory be burned the resulting heat radiation from the uncovered ground would seriously hamper the essential operations of this delicate but giant camera for a number of years.

4. This county, State, and Federal cooperation in men and money has also resulted in several important firebreaks serving to protect communities lying in the forest and brushland areas. Not only will these firebreaks serve to keep structural fires originating within the populated centers from entering into the surrounding watersheds and forested areas, but they will also stop the fires originating in the unpopulated areas from entering the protected communities. Citizen forestry study group sponsored firebreaks now adequately protect the communities of Harrison Park, La Cresta, Pine Hills, and Pine Valley.

STATE OF CALIFORNIA'S CONTRIBUTION TO THE PROGRAM

From the California State Legislature our citizens forestry group has secured greatly increased appropriations to the California Division of Forestry to provide more adequate watershed protection and forest and brush fire prevention in San Diego County. The State now has a protection budget of $811,664 in San Diego County. This last fiscal year the State spent an estimated $100,000 from an emergency fund for forest fire suppression in the county. In addition, the State now has 180 men in State forestry honor camps working on forestry projects, contributing some $249,600 annually in labor valued at only $8 per day. The study group has been helpful in securing a fourth State forestry camp for our county, which will bring the number of prison laborers to 240. The State also allots $36,310 yearly for the protection of private and State lands within the Cleveland National Forest.

MORE ADEQUATE FEDERAL FINANCING IS URGENTLY NEEDED

Our citizens forestry study group of San Diego County has repeatedly requested the United States Forest Service, the Department of Agriculture, the Bureau of the Budget, and the Congress to provide an adequate level of fire protection for our own Cleveland National Forest. Our requests are based on the planned needs of the forest as presented by the supervisor of the Cleveland. These needs have been studied by the group and have been determined as essential to the results we seek. They are in line with the level of protection we ask and have received from the local responsible city, county, and State agencies. They have been coordinated with the needs of 3 other national forests through our watershed fire council of southern California, of which our group is 1 of 4 constituent members.

We note that the Cleveland's fire-protection budget for the current 1957–58 fiscal year again appropriates $177,000 for use in San Diego County which constitutes approximately two-thirds of the Cleveland National Forest. And we stress the fact that in this last year the emergency fire-fighting fund of the Forest Service has been called upon to pay approximately $666,500 for fire suppression in this county, since 85 percent of all Cleveland fires this past year have occurred here. An additional fund of $61,000 was appropriated by the governmental agencies to reseed the two large burns of the current year, the Pine Mountain and the Inaja forest-fire burns.

The group is pleased that the Department of Agriculture and the Congress have met our requests for additional funds in part. The Cleveland National Forest was given its pro rata share of the supplemental appropriations for fiscal years 1955, 1956, 1957, and 1958. We have seen these funds put to wise use in stronger fire prevention and initial attack. The man-caused fires dropped from 44 in 1953 to 27 in 1954, to 17 in 1955, but zoomed to 39 in 1956. Burned acreage for the same years dropped from 10,675 acres to 6,403 acres, to 363 acres, and then went up to 39,964 last year. Two large fires, one caused by a falling military plane and the other by a subnormal Indian boy, contributed to the greater acreage burned, and the staggering suppression cost.

We know of instances where fires were controlled this year under extremely hazardous conditions by the initial-attack crews due to the increased manpower, where heretofore similar fires have escaped to cause losses and fire-fighting costs that ran to the hundreds of thousands of dollars. We firmly believe that this outstanding record in fire prevention and suppression is due in part to the supplemental funds provided. I say, in part, because I again would like to call your attention to the local participation I have mentioned and which we know must also be adequate if the Forest Service is to do a good job of watershed protection and the prevention of forest and brush fires on the Cleveland National Forest.

We had a bad year in 1956 on the Cleveland National Forest which proves that the present level of protection is still far from adequate for acceptable results year after year. While fire prevention and initial-attack forces have been substantially strengthened, sound fire-control planning shows that weak spots still remain. Fire-control roads are inadequate and unsafe in places. Quarters for fire-control personnel are also inadequate and substandard in places. Fire preplanning should be extended to all of the more critical watersheds. Year-long financing for foremen, drivers, and prevention aids would provide the know-how and manpower to predetermine fire-control lines, water sources, heliports, and firebreaks on the ground before a fire occurs.

There are jobs to be done in fire research and the improvement in communications and equipment. Fire-protection salaries must be uniform between agencies to prevent injustices. We are still in great need of a year-round strong fire force to meet the dreaded Santa Ana conditions that occur frequently during the so-called off season and maintain a corps of fire-fighting experts to train new people in scientific fire protection.

Our request of 4 years ago for an annual appropriation of an additional $312,000 for the Cleveland National Forest remains imperative. Our group urges all concerned to budget and appropriate not only the increases of fiscal years 1955, 1956, and 1957, but the additional funds required to meet the full estimated amount for adequate protection. This sum is required annually for a period of 10 years to enable the Cleveland National Forest to reach a satisfactory level of watershed protection and prevention of forest and brush fires.

To properly represent the feelings of our group in this matter of increased appropriations, I must state that the members are not happy with the high budgets of governments. In this instance, however, we are not at all happy at the excessive costs and losses resulting from forest fires not being prevented or escaping from control when small. Our experience and our studies have given us the firm belief that only through adequate fire preparedness can we achieve watershed protection at the least cost, and eliminate the recurrence of such tragic fire losses as those of the Inaja Forest fire of November 1956.

Total, all sources, expenditures for watershed protection and forest and brush fire prevention in San Diego County for 1956–57

Source	Amount	Administrating agency		Other agency
		California Division of Forestry	Cleveland National Forest	
Individuals and private agencies:				
San Diego District Federation of Womens Clubs	$537.79		$537.79	
Conservation Association of Southern California	75.00			
Individuals in study group for poster contest	100.00	$175.00		
Citizens forestry group, dues $50; gifts $100	150.00			$150.00
Sportsman for wildlife habitat improvement	1,000.00		1,000.00	
Landowners Alford & Mead for Inaja burn reseeding	362.62		362.62	
Total	2,225.41	175.00	1,900.41	150.00
Fire protection districts (8 out of 20 in county are in wild land areas)				
Irrigation and water districts:				
Escondido Water Mutual District	407.34		407.34	
Vista Irrigation District	407.34		407.34	
Helix Irrigation District	450.00	450.00		
First 2 for reseeding Pine Mountain Mountain Forest burn. Latter Inaja burn reseed.				
Total	1,264.68	450.00	814.68	
City of San Diego:				
Annual agreement	5,950.00		5,950.00	
Reseeding Inaja burn	4,305.00	4,305.00		
Total	10,255.00	4,305.00	5,950.00	

Total, all sources, expenditures for watershed protection and forest and brush fire prevention in San Diego County for 1956–57—Continued

Source	Amount	Administrating agency		Other agency
		California Division of Forestry	Cleveland National Forest	
County of San Diego:				
Annual agreement	$8,000.00		$8,000.00	
Forestry study group, sponsored projects	15,000.00	$7,500.00	7,500.00	
Honor camp labor valued at $8 per day	46,220.00	7,700.00	38,520.00	
Reseeding Inaja burn	4,305.00	4,305.00		
Annual agreement	112,383.00	112,383.00		
Total	185,908.00	131,888.00	54,020.00	
State of California:				
Budget, San Diego County Division of Forestry	811,664.00	811,664.00		
Forest fire suppression emergency fund	100,000.00	100,000.00		
State forestry honor camp labor at $8 per day	249,600.00	249,600.00		
State grant to Cleveland National Forest for fire protection of private and State lands within its boundaries	36,310.00		36,310.00	
Reseeding private lands, Inaja Forest fire burn	10,216.00	10,216.00		
Total	1,207,790.00	1,171,480.00	36,310.00	
Cleveland National Forest:				
Annual fire protection budget, prorated ⅔ to San Diego County	177,000.00		177,000.00	
Resource management: grazing, recreation, roads, insects	195,800.00		195,800.00	
Fire suppression costs based on 85 percent of total	666,513.00		666,513.00	
Department of Agriculture emergency fund for reseeding Federal land, Inaja fire burn	38,296.00			
Bureau of Land Management	7,140.00			
U. S. Indian Service	4,000.00			
Department of Agriculture for road erosion control—Inaja	10,350.00			
Total for Inaja reseeding	(59,786.00)		59,786.00	
Reseeding Pine Mountain fire burn, U. S. Department of Agriculture	965.00		965.00	
Total	1,100,064.00		1,100,064.00	

RECAPITULATION

Individuals and private agencies	$2,225.41	$175.00	$1,900.41	$150.00
Irrigation districts	1,264.68	450.00	814.68	
City of San Diego	10,255.00	4,305.00	5,950.00	
County of San Diego	185,908.00	131,888.00	54,020.00	
State of California	1,207,790.00	1,171,480.00	36,310.00	
Cleveland National Forest, U. S. Department of Agriculture	1,100,064.00		1,100,064.00	
Total	2,507,507.09	1,308,298.00	1,199,059.09	$150.00

The CHAIRMAN. It would be appreciated, Mr. Sarafian, if you will identify yourself by name, address, and whom you represent. We are trying to limit presentations to 5 minutes in order to allow a little time for the committee members to ask questions.

STATEMENT OF ARMEN SARAFIAN, CHAIRMAN, PASADENA AREA COMMUNITYWIDE COMMITTEE ON CONSERVATION

Mr. SARAFIAN. Thank you very much, gentlemen. It is a real pleasure to be here.

My name is Armen Sarafian, Pasadena, Calif. I am administrator in the Pasadena city schools and also chairman of the Communitywide Committee on Conservation.

This morning we heard from some of the people about the damage that teen-agers are doing with their vandalism and maliciousness, and so on, in starting some fires. This Communitywide Committee on Conservation is concerned about that sort of thing. The committee consists of 100 members, 60 of whom are civic leaders interested in conservation and 40 of whom represent the elementary, junior, and senior high schools and junior college of the Pasadena area. Our committee has many chairmen of conservation activities from service and civic groups and from such organizations as the Audubon and Sierra Clubs. It meets once a month for the purpose of—

1. Evaluating our school and community programs of conservation education;
2. Joining together in the writing and preparation of booklets and films on our San Gabriel Mountains; and
3. Finding ways of instilling greater conservation-mindedness in our youth.

We are vitally concerned with what happens to our San Gabriel and San Bernardino Mountains, and we have undertaken a number of very careful studies in relation to it. We have heard people from Los Angeles County Arboretum tell us about fire-resistant plants. We have gone out to San Dimas Experimental Forest and looked at the studies going on at that place. We have heard from people in the United States Forest Service; we have heard from eminent professors in biology in our area on flora and fauna, and we have also had conservation bus trips for teachers and for citizens as we have gone out to various mountain areas to study them carefully.

Those of us who are native sons and daughters of southern California can remember vividly the consequences to our valleys when fires denude our mountain playgrounds. We recall such tragic occurrences as the 1934 La Crescenta flood which was the aftermath of a burn of the protective cover at upper elevations. We know the importance of our chaparral in retaining the topsoil, the rocks, and the debris that would otherwise plunge mercilessly into the valleys below, wreaking death and destruction to our heavily populated foothill towns and cities.

We know this chaparral is indigenous to the area, as far as these studies we have made, it does not appear to us that any other known grass or herb at this time can take the place of the chaparral as a protector of the mountainsides, as a preventer of topsoil erosion and floods. This is made up of a number of tough evergreen plants peculiarly suited to the dry winters, and they must utilize for growth those relatively short periods in the spring, fall, or, really, at other times of the year when there is enough moisture and heat at the same time to permit plant life to develop. Up to this day it just does not appear that other plants can do the kind of thing chaparral is doing in our own particular mountains.

We have been told that the soil on our rugged mountains is perched at a more precipitous angle than can be found on mountains in other parts of the United States. We have learned, too, that it consists mostly of decomposed granite and therefore is very unstable. After a severe fire, such as the recent one near Morris Dam, one can actually hear the loose soil rattling down the mountainside even when it is dry.

If you have just a little bit of water, you can imagine what that would do.

We are indeed fortunate that this loose decomposed stuff is held on our steep mountain slopes by the root structure of our elfin forest. Without this thick tangle of natural cover our costly dams, reservoirs, water spreading grounds, and flood control channels would soon be filled with silt. As taxpayers we cannot tolerate the expensive cleanup and rebuilding that will be necessary if our officials fail to capitalize on nature's plan for holding this soil in place.

In these seasons of extreme drought, we are more conscious than ever of the value of the watersheds in the mountain playgrounds in our own backyard. Even the slightest drop of water is an economic necessity to our parched southland. Protection of our elfin forest, therefore, is sine quo non to survival. Every man, woman, and child in the Los Angeles metropolitan area is tremendously affected by actions relating to our San Gabriel Mountains, and that is the reason our Pasadena Community Committee on Conservation is so vitally concerned about the outcomes of your hearings.

We heard a number of things this morning about proposals to burn off the cover. We were kind of surprised at these proposals. It is the same thing as eliminating traffic accidents by eliminating cars, and you will not have any; eliminate juvenile delinquency by getting rid of all teen-agers—you will not have any.

The city of San Francisco had a number of very critical fires over the past century of history. That seemed to be a cycle arrangement until they got adequate fire protection in the city of San Francisco. No person in his right mind would propose that we go into the city of San Francisco and eliminate all of the combustible materials, all the buildings, and so on, that will burn. Yet it seems to me some of the proposals are in that vein.

In our committee sessions we have examined the work of the United States Forest Service in giving care and protection to our Angeles National Forest. We are greatly impressed by the quality of our forest service personnel. We also admire their desire in using the latest and best means of quelling fires. A number of incipient holocausts this past summer were snuffed out by aerial tankers, chemicals, and "helitack" operations. Some fires in virtually inaccessible areas were confined to less than 40 acres, whereas a few years ago they would have burned and burned and burned.

One of the most devastating fires—because of its potential menace during the rainy season—was restricted during the month of September to a burned area of about 2,500 acres. Tragic as this loss is it could easily have devastated many thousands of additional acres. Some of us recall the destructive fire of 1924 in the same area when, over a period of several weeks, flames denuded a far greater territory as they leaped into wild, steep hinterlands almost to the desert.

Modern and efficient means of fire fighting have much promise for the welfare of our elfin forests. The problem is that there are not enough facilities and manpower to give the year-round protection so urgently needed during the dry Santa Ana windy seasons of September to February. There does not seem to be a sufficiently thorough understanding of the factors that make fire fighting so difficult in the San Gabriel and San Bernardino ranges such as

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1. The inaccessible terrain;
2. The steep slopes; and
3. The difficult weather conditions.

What I have attempted to do in the last 3 or 4 minutes is to point out the following factors that our Pasadena Area Communitywide Committee on Conservation feels the House Committee on Interior and Insular Affairs should take into account as it considers legislation affecting fires in our mountains: First, the consequences of fire in our Angeles and San Bernardino National Forests are especially serious to the residents, businesses, and industries of the Los Angeles metropolitan area because of the

(*a*) Flood hazard created by the rapid runoff down steep, denuded slopes. Debris and erosion-produced materials carried by the floodstreams have an abrasive effect on the expensive developments of our Coastal Plain.

(*b*) Damage to our water supply caused by the following conditions:

1. Filling up of our storage basins because of silt and debris.

2. Scouring out and clogging of natural water channels and thereby lowering the water tables which would benefit by normal distribution through these channels.

3. Reducing the amount of water percolating into the ground. As debris washes down the mountain sides, it seals up the tiny pores in the earth and prevents water from penetrating to underground natural reservoirs. Plants hold back water, slow down its flow, and spread it over a wider surface so it will percolate down.

Second, the need for increased funds to improve the protection of our mountains. The salaries for fire crews must be increased to a level commensurate with the same service for counties and municipalities. Additional equipment in the form of radio facilities, aerial tankers, helicopters, and other mechanical devices should be furnished. Improved housing for men in the employ of the United States Forest Service is needed and ranger stations should be expanded.

The Forest Service should be made much more attractive for our young men to enter.

Above all, fire prevention, observation, control, and suppression should be placed on a year-round basis in the southern California mountains and forests.

The needs are many, the job is big, and the challenge is great. Our future rests on wise decisions and action now. We leave it up to you.

Thank you very much.

The CHAIRMAN. Thank you very much for your statement.

Do you have any questions, Mr. Sisk?

Mr. SISK. I have a couple of questions, Mr. Chairman.

Mr. Sarafian, actually I would like to direct this to all three of you gentlemen, because I think generally your testimony has been very similar.

We are concerned, of course, with what we can do here to eliminate these wild conflagrations that seem to be occurring here regularly.

By the way, I would like to ask this first: Do any of you deny that there has been a cycle of fires throughout all recorded history and there has been a burning off generally every 10 to 20 years?

Mr. ROBERTS. I do not think I understand your question.

Mr. SISK. Let me put it this way, then: Is it true, the testimony we have heard in the last couple of days with reference to the fact

that as this fuel builds up on the ground there has been more or less a cycle and regular series of fires, that it has been burning off regularly?

Mr. SARAFIAN. Is it the assumption it is inevitable?

Mr. SISK. I am not assuming anything, Mr. Sarafian. I just asked you a question.

Mr. SARAFIAN. This may be true. I am not enough of an authority to realize whether it comes in cycles or not. But in our studies, it does not appear to be the inevitable type of thing.

As I pointed out, where fires can be suppressed quickly, through modern means—helicopters, tankers, and hot-shot crews—we do not have fires in that region.

Mr. SISK. The point I was trying to get at is this: Many of us feel we need more imaginative programs in an attempt to solve this situation. We are all very thoroughly familiar with the problems of soil erosion, because it not only exists here but exists in many other areas.

I do not mean this to be critical, but your program seems to represent a problem of us appropriating such money as to put a crew behind every bush. That is literally impractical, gentleman. The thing we are concerned with is whether or not you have suggestions, let us say, of a visionary nature, or of a nature which would tend to solve this situation in some practical aspect.

There have been suggestions made, which I understand you disagree with, with reference to burning. I think no one has come here and advocated broadcast burning on steep elevations, because it is rather ridiculous. But there have been some very good statements made on control burns, spot burns, and so forth. I would like to have you comment on that.

The CHAIRMAN. Mr. Roberts.

Mr. ROBERTS. Mr. Sisk, I do not know how we can sell the idea. You would not consider in the city of Los Angeles, for example, hiring a fire department from 8 to 5. Yet you do that in many respects in the United States Forest Service. I would like to know why, when you have a 12-month season, you cannot have a 12-month fire department.

I would like to put it back in your lap, you fellows who appropriate the money for these fire departments. Why do you shut these fellows off at 8 months? You know you cannot hire a good man to work for you in your business for 8 months out of the 12. Why do you think the Forest Service can do it?

Mr. SISK. Let me say that generally we ask the questions, but I will comment on your question to this extent:

I am sure you understand the division of powers of our Government. The Congress is the appropriative body, and we appropriate generally such moneys as are requested by the executive branch of Government and approved by the Bureau of the Budget. Sometimes we increase it a little bit, sometimes we may cut it back a little bit. But we are not telling the Forest Service what to do. The Forest Service is running the show, and certainly it has been our belief and the intent of Congress that the Forest Service does the very best job it can of protecting the forests the year round. There has never been any indication or any desire on the part of Congress or anyone else I know in the Government to put the Forest Service on an 8-hour day or an 8-month year. That is wholly beside the question.

The CHAIRMAN. Let the Chair suggest he is not going to sit here and preside over a debate. We are here to secure information, and that is precisely what the Chair wants to do.

The fact of the matter is Mr. Sisk was elected to Congress in 1954. He did not have anything to do with this failure to put that program into execution down there in San Diego. The fact of the matter is that the only way to do those things is to keep a hot iron on somebody's back end all the time and we have not had time enough to keep hot irons going. But let us limit this discussion to the eliciting of information and not argument. We want the views of the witnesses, but let us refrain from argument.

Mr. ROBERTS. Mr Chairman, I am just trying to answer his question.

Mr. SISK. I believe Mr. Parratt has a comment he would like to make.

The CHAIRMAN. We are glad to have your views, Mr. Roberts, but just do not let us get into cross fire of arguments.

Mr. PARRATT. I would like to say, according to the studies of the California Institute of Technology and the San Dimas Experiment Station, there is no satisfactory substitute for the chaparral as a cover to hold water, which we are mainly concerned with in this area.

I would like to make one short quotation from a miscellaneous paper put out by the staff of the Division of Research at San Dimas, April 5, 1951:

> In a study of more than 1,000 infiltration tests in various ranges no case was found in which heavy grazing or burning of the vegetation, other conditions being equal, failed to result in a decrease of infiltration capacity of the soil.

In other words, in all the experiments that were done at San Dimas they found no case where either heavy grazing or burning resulted in anything else but a loss of the water-holding capacity of the soil.

Mr. SISK. Thank you, gentlemen. I appreciate your comments. We are here strictly to get information in an attempt to help and assist in this problem in such ways as we can. Of course, there are differences of opinion, there is controversy; and certainly I think controversy makes for a better solution possibly of the problem.

Thank you, Mr. Chairman.

The CHAIRMAN. I would like to say, Mr. Roberts, I think you put your finger on the two crucial things that ought to be done right away. There are other things that are broader, but those are two mechanical things that would certainly go a long way toward solving this problem. We appreciate your testimony and your coming here.

Is Mr. Carter still here?

Mr. CARTER. Yes.

The CHAIRMAN. I should have mentioned some time ago that your prepared statement was before us when we had the first group of witnesses this morning, many of whom testified regarding the same general subject matter. In fact, one of those witnesses had in his prepared statement some of the same figures used in your statement. I intended at the time to call the attention of the subcommittee to that fact, although your statement is more complete and the figures given are more comprehensive.

Unless some member now has some questions to address to Mr. Carter, I wanted to say it would not be necessary for you to remain if you do not want to. We will be glad to have you here.

Mr. CARTER. I am enjoying it very much.

The CHAIRMAN. I would like at this point to request that the regional forester, Mr. Connaughton, submit a statement to the committee relative to whether or not the Forest Service has ever suggested or made a concrete proposal to the chief forester and the Bureau of the Budget regarding the maintenance of the southern California Forest Service operation on a year-around basis. Mr. Connaughton, will you prepare a statement to be submitted for the record on that subject?

Mr. CONNAUGHTON. I will be very glad to, and I will submit it by mail.

The CHAIRMAN. Without objection, that will be included at this point in the record.

Furthermore, I would like to have a statement submitted for the record, Mr. Connaughton, regarding whatever recommendations have gone to Washington and to the Bureau of the Budget relative to the adjustment of wage differentials.

(The report follows:)

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C., October 23, 1957.

Mr. R. E. MCARDLE,
Chief Forester, Department of Agriculture,
Washington 25, D. C.

DEAR MR. MCARDLE: On October 9 toward the close of the hearings held in Los Angeles by the special subcommittee to consider forest fires in southern California, I submitted the following questions to Regional Forester Charles A. Connaughton:

1. What action has been taken, to date, by the Forest Service to solve salary disparities between fire-control personnel in California?

2. What are the opportunities, through use of Wage Board procedure, to meet the problem of salaries for fire-control people?

3. What representations have been made by the Department to the Bureau of the Budget to solve yearlong staffing needs on fire-control work?

I realize that the records relative to these questions are largely in the Washington office and will appreciate your cooperation in the preparation of answers which can be referred to in the committee report and also incorporated in the hearings.

The testimony submitted by Mr. Connaughton and his associates was very helpful to the committee. I regret that none of the members of the special subcommittee were able to accept his invitation to participate in an inspection trip of the national forests in southern California. However, Mr. Collingwood of the committee staff took advantage of the opportunity and has told me that the information secured will be exceedingly helpful.

Sincerely yours,

CLAIR ENGLE, *Chairman.*

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., November 21, 1957.

Hon. CLAIR ENGLE,
Chairman, Committee on Interior and Insular Affairs,
House of Representatives.

DEAR CONGRESSMAN ENGLE: Your letter of October 23, 1957, has been received. In compliance with your request we have compiled a statement bearing on the three questions you posed to us in connection with your recent hearing on forest-fire problems of southern California. The statement is attached and we believe it answers questions in your letter and also those asked by other members of the committee at the hearing in regard to possible use of wage board procedure for fire control employees.

Very truly yours,

RICHARD E. MCARDLE, *Chief.*
By W. S. SWINGLER.

1. What action has been taken, to date, by the Forest Service to solve salary disparities between fire-control personnel in California?

Effective fire control can be accomplished only by designing and maintaining a highly skilled and stabilized force. An effective force must have an adequate number of capable people. The present general schedule salary scale places the Forest Service in an unfavorable position—in the highly competitive market for capable men. Industry, State of California, and Los Angeles County offer higher salaries and other desirable incentives. This situation, which has grown worse over the years, became acute in 1956. Since then it has not improved. Comparison of Federal classified salary rates with rates paid by the State of California and Los Angeles County shows an alarming discrepancy. Attached is a 1-page comparative summary of monthly salary for 6 grades by various agencies. Recent (1957) increases in the State of California wage schedule further aggravate the situation.

Action taken by the Forest Service

(*a*). Request for increased minimum rates: In July 1956, the California region of the Forest Service analyzed the situation. A request was made, supported by facts and explanation of the critical situation, to the 12th civil service region, San Francisco—asking authority to pay increased minimum rates for fire-control aids, grades GS–2 to GS–7, inclusive. Essentially, the request based on comparative salary schedules was to raise the pay rates for fire-control people in classified positions from the minimum rate to the seventh step in respective grades. For example, GS–5, fire-control aids—minimum rate $3,670 ($305 per month)—request to pay for this grade $4,480 ($373 per month).

This request was made in compliance with title VIII of the Classification Act of 1949, as amended by Public Law 763, effective September 1, 1954. Procedure for requesting increased minimum rates of pay for classified people is outlined by civil-service regulations contained in the Federal Personnel Manual, section R2–65. In this request it was pointed out that rates for classified people had not kept pace with economic trends in California. Rates that could be paid fire-control people in classified positions had definitely fallen behind salary and wage rates paid by industry, State of California, and competitive counties.

The 12th civil service region, San Francisco, reviewed the Forest Service request and submitted the proposal to the central office of the Commission. The Commission in considering such requests under provisions of the Classification Act, requires various data to justify the increase in rates. Of special importance is the need for showing that every recruitment device is used to increase the supply of applicants. It therefore asked that a competitive examination with revised qualification standards first be established so that recruitment might be improved through offers of career conditional appointments. This examination was announced on March 18, 1957, but subsequent experience in the use of the exam in relatively low yield of additional recruits is such to indicate that our request for rate adjustments should now be renewed. We expect to do this in the immediate future.

(*b*) Use of differential pay procedure: Public Law 763 (83d Cong.) and civil-service regulations pursuant thereto authorize agencies to pay a differential in lieu of overtime pay for classified employees who regularly are required to perform overtime work or standby duty for extended periods of time. The provisions of this law have been applied to classified fire-control employees in the Forest Service. The amount of differential allowed is based on the best available forecast of the tour of duty which will be required for the particular job during the current season. However, the fluctuating nature of fire danger, fire occurrence and duration of fire-fighting duty, plus the wide disparity of fire severity between seasons preclude preparation of accurate forecasts of the tour of duty actually required. The pay differential has been an advantage in providing additional compensation for fire-control employees required to remain on standby duty for extended periods. However, problems have arisen particularly during a severe fire season when employees are required to perform large amounts of overtime work or standby duty in excess of estimates.

The problems relating to establishing a pay differential as it applies to Forest Service fire-control employees had been discussed with the Civil Service Commission. During the 85th Congress a bill (S. 1901) was introduced to amend section 401 of the Federal Employees Pay Act of 1945, as amended, and to provide payment at applicable rates for overtime duty in excess of an employee's regularly scheduled weekly tour. If enacted, it would provide pay

differential for all work and standby duty within an employee's regularly scheduled tour and overtime pay at applicable rate for duty outside of the regular tour. The bill passed the Senate on August 5, 1957, after a favorable report by the Budget Bureau and a "no objection" by the Civil Service Commission. Enactment of this bill would materially help rectify the differences in take-home pay between Forest Service and local agencies.

(*c*) Development of new classification standards for fire-control aids: Present classification standards for fire-control aids were issued by the Civil Service Commission in 1947. The nature and character of fire-control work in all regions of the Forest Service have changed sharply in the last decade, especially in California.

A study was made of the changes, and, as a result, new classification standards are being developed for fire-control personnel. Early in 1957 specific plans were drawn to revise the standards for fire-control aids. We expect to have the suggested changes worked out around the first of the year. When adopted, these revised specifications will enable the Forest Service to offer better promotional opportunities.

The higher grade levels, however, would not under present conditions entirely solve the problem. The lag in Federal classified salaries behind that of wage levels in industry and some States is also a significant factor. Essentially the dollar equivalent of comparable grades or job responsibilities is lower than it is in some counties and some States. Consequently, the problem goes beyond mere revision of standards.

New standards, however, will help the present situation materially by more properly grading people for work assignments. This is an essential first step.

(*d*) New classification standards (460 series): In March 1957 the Civil Service Commission approved a new classification standard for professional foresters. Action is being taken to grade properly foresters' positions according to the new standard. This new standard will be a distinct help by placing all professional foresters—including those in fire-control activities—in proper grades. For professional foresters the new standard offers opportunity for better careers and should serve to attract and hold competent professional foresters. This standard is, of course, not applicable to nonprofessional employees.

(*e*) Above minimum hiring rates for professional foresters in grades GS–5 and GS–7: In September 1956 the Civil Service Commission approved hiring professional foresters with bachelor's degrees at the fifth step of grade GS–5, $4,210 ($350 per month) as compared to the former entrance rate of $3,670 ($305 per month). Similar action was taken to raise the salary for foresters in GS–7 from the entrance step of $4,525 to the fourth step at $4,930. The added salary accorded the GS–5 and GS–7 professional foresters has aided recruitment and retention of professional foresters—many of whom are closely associated with fire-control activities.

(*f*) Housing: Suitable housing for professional field employees including those in fire control has been a problem for many years in the many areas where privately owned rental properties are not available. Professional fire-control employees have received equal consideration in the use of regular program appropriations for providing more and better housing in localities where adequate commercial rental opportunities are not available. Progress has been made to provide this housing through the conversion of nonpersonnel buildings to barracks, messhalls, apartments, and individual living quarters; the procurement of used or surplus property trailers, improved tent camps; and the construction of new buildings.

The increases recently received for this purpose will be of assistance, but it will take many years to complete the needed building program at the present construction rate.

(*g*) Increase in length of employment: Career opportunities and yearlong employment are other important considerations in maintaining a competent fire-control organization. These factors relate to the salary and other benefits available to employees in competing agencies. Sustained efforts have been made by the Forest Service to lengthen periods of employment and thus utilize the experience and training of fire-control people on a yearlong basis. Through analysis, careful planning, programing of work and budgeting of all funds there has been gradual increase in periods of employment—but the opportunities to do this and the funds available have limited the number.

Increase in financing received for doing other jobs has helped in providing longer periods of employment for fire-control personnel as well as other em-

ployees of the Forest Service. Some fire-control personnel can be shifted to other work in the winter thus increasing their overall periods of employment. The limitations to this integrated financing depend upon total availability of funds and competing needs for manpower for efficient work performance of the several jobs, many of which can be best or only accomplished during the fire season.

In California all fire-control personnel employed by the Los Angeles county forester and fire warden are yearlong. The State organization gives yearlong employment to all fire-control personnel except firemen and some fire-truck drivers.

2. What are the opportunities, through use of wage-board procedure, to meet the problem of salaries for fire-control people?

Classification standards were revised in 1947 for forestry aids and fire-control aids. Our policy has been to place in classified general schedule grades all fire-control aids, as well as forestry aids—whether employed in temporary, seasonal, or permanent full-time positions.

Emergency fire-fighting personnel such as unskilled, semiskilled, skilled labor, truckdrivers, sector bosses and related facilitating personnel have been employed by the Forest Service at local rates. This is the traditional way in which the Forest Service has hired these emergency types of personnel for fire suppression work. Wages for these people are fixed by wage-board procedure—with current adjustments made as locality wage trends dictate.

In fire suppression work wage rates for emergency personnel hired by the Forest Service are correlated with the particular State or States involved so uniform salary rates are used by all agencies. This is especially true in California where not only are the emergency fire-fighting rate schedules correlated with the State but with Department of Interior agencies—National Park Service, Indian Service, and Bureau of Land Management. No problem exists in wages for emergency fire-fighters since their wages can be currently adjusted as conditions warrant.

Consideration and study have been given to the opportunities of using the wage-board procedure to remedy the acute problems of classified fire-control personnel. Existing legislation, the Classification Act of 1949, title II, section 202 (28), provides for eliminating from classification, emergency temporary or seasonal positions. Section 202 (7) also provides for eliminating from classification, positions dealing with:

"Employees in recognized trades or crafts, or other skilled mechanical crafts, or in unskilled, semiskilled or skilled manual-labor occupations (except such employees in positions to which the Classification Act of 1923, as amended, now applies, the duties of which involve the maintenance and operation of public buildings and associated equipment or the performance of work in scientific or engineering laboratories as aides to scientists or engineers), and employees in the Bureau of Engraving and Printing the duties of whom are to perform or to direct manual or machine operations requiring special skill or experience, or to perform or direct the counting, examining, sorting, or other verification of the product of manual or machine operations, whose compensation shall be fixed and adjusted from time to time as nearly as is consistent with the public interest in accordance with prevailing rates."

Under the language of sections 202 (7) and 202 (28) of the Classification Act opportunities to further ungrade classified positions are limited due to factors of nature of the work and tenure of appointment.

In an organization like the Forest Service wages and salaries paid people should be kept in balance and in proper relationship. To maintain balance and equity in salaries among people who are all members of the same team calls for use of a common pay schedule. To pay a temporary fire-control aid a premium wage and a permanent full-time fire-control aid doing identical duties a classified wage would bring about an almost impossible morale problem and jeopardize the teamwork essential for effective actions. Consequently the Service has over the years paid all fire-control aids at classified rates.

Actually the primary problem is that we have these conditions: (1) A steadily increasing gap between the general schedule classified rates and the rates paid elsewhere for comparable work and (2) operation under two diverse systems of setting rates (*a*) wage-board rates which are currently adjusted to fit local prevailing rates and (*b*) statutory rates fixed by Congress on a nationwide basis.

From review of the situation with particular reference to the conditions prevailing in southern California, we must conclude that while wage-board pro-

cedure for all fire-control people in this area would enhance the competitive position of the Forest Service it would simultaneously create serious morale difficulties among related personnel, foresters, and others which might impair the overall effectiveness of the organization. It would result in serious inequities which could not be resolved. It would remedy one situation but would create others which might offer more serious difficulties. However, further study is being given to the possibilities of using wage-board procedure for some of the presently lower graded fire-control positions to determine to what extent the positions could be ungraded at these levels without serious impact on morale of employees at higher classified levels in the fire organization.

The whole area of Federal pay has been under recent study by a special Cabinet committee whose general objective was to appraise the effectiveness of present pay systems in the Federal Government. While the results of this study have not yet been announced it may be that subsequent action ensuing from this study might afford some relief on this particular problem.

3. *What representations have been made by the Department to the Bureau of the Budget to solve yearlong staffing needs on fire-control work?*

The record indicates that requests for fire-control appropriation increases from the Department to the Budget Bureau have involved primarily additional seasonal force employment to build up the initial attack fire forces. Requests have not been made specifically for additional funds to solve yearlong staffing needs. On the basis of priorities it has been considered essential to provide adequate initial attack forces on a seasonal basis before requesting funds for yearlong staffing.

As stated in reply to question No. 1, increases in funds for other purposes than fire control have helped in extending employment of seasonal fire-control personnel.

MONTHLY BASE SALARY DIFFERENCES PAID FOR SIMILAR TYPE OF FIRE-CONTROL WORK

1. Forest Service classified positions.
2. Division of Forestry, State of California.
3. Los Angeles county forester and firewarden.
4. Wage-board rates used by all California agencies for emergency fire-fighting work.

[Per month, 1956]

Federal class, grade	Salary	State of California	Los Angeles County	Wage board	Average State, Los Angeles and wage board	Difference in GS rate versus competitors
GS-2:						
Begin	$247	$255	$375	$293	$308	−$61
Top	289	310	464	320	365	−76
GS-3:						
Begin	265	325	417	327	356	−91
Top	307	358	516	364	413	−106
GS-4:						
Begin	285	325	417	349	364	−79
Top	327	395	516	396	436	−109
GS-5:						
Begin	305	358	464	392	405	−100
Top	373	436	575	464	492	−119
GS-6:						
Begin	340	395	----------	392	393	−53
Top	407	481	----------	487	484	−77
GS-7:						
Begin	377	436	464	----------	450	−73
Top	445	530	575	487	531	−86

NOTES

Since this table was prepared, State rates have been increased an average of 5 percent.

Los Angeles County employees work 66½ hours per week in 24-hour shifts. Their full week's employment is accomplished in less than 3 days. If called back they receive overtime.

State employees work 5 days per week and are given a differential of about 10 percent for standby during the 5 days. When worked on the 6th and 7th day they are given compensatory time or overtime pay.

Forest Service employees, during the height of the fire season, receive 15 percent (or 25 percent in some cases) for all standby and all fire fighting performed any time in the 7-day week. They are kept on standby in accordance with needs determined by fire danger at the time. While in differential pay status, they receive no overtime for work on the 6th or 7th day, or compensatory time.

The CHAIRMAN. Mrs. J. B. Atkisson. Will you state for the record your full name, address, and whom you represent, if anyone other than yourself?

STATEMENT OF MRS. J. B. ATKISSON, CHAIRMAN, CONSERVATION OF NATURAL RESOURCES, VERDUGO DISTRICT, CALIFORNIA FEDERATION OF WOMEN'S CLUBS, PASADENA, CALIF.

Mrs. ATKISSON. I am Mrs. J. B. Atkisson. I am from Pasadena, Calif., and I represent the Verdugo District of the California Federation of Women's Clubs. We are approximately 30 clubs in the area nestling right up against the foothills.

The CHAIRMAN. These are the California Federation of Women's Clubs?

Mrs. ATKISSON. Yes, the California Federation of Women's clubs.

The CHAIRMAN. Did you say you had 30 clubs or 30 women—which?

Mrs. ATKISSON. We have 30 clubs in towns nestling right up against the foothills. We represent approximately a membership in that district of 4,000 women.

The CHAIRMAN. Very fine. Thank you very much.

Mrs. ATKISSON. We of the Verdugo District of the California Federation of Women's Clubs are familiar with the peculiar problems that are presented in maintaining the watersheds, controlling the fires, and preventing erosion in the mountainous areas of southern California. Throughout the State of California the Federation of Women's Clubs are actively engaged in reforestation. Our women are collecting funds to establish cooperative planting programs on the national forests.

We of the Verdugo district have the distinction of being the first of several organizations to establish such a cooperating planting program in our own Angeles National Forest.

At the present rate of annual Federal appropriations for reforestation, it will take several hundred years to reforest the burns and the denuded areas of our State. In fact, I believe the exact figures are 450 years to reforest the burned areas of California.

Now, the California Federation of Women's Clubs and many other organizations are attempting to supplement these insufficient funds. While our attempts may be laudable, the financial resources of these organizations are very limited and are inadequate to provide a competent reforestation program. It is, however, significant to note that the action of these organizations reflects a general awareness on the part of the public of insufficient Federal appropriations for the work of the Forestry Department.

We are aware of the effort being put forth by the United States Forestry Service in both the fields of research and applied research in the control of fire and erosion in these mountains. We are in accord with this program, and we would like to see every effort made not

only to support this program but to accelerate its activities in the interest of the safety of the inhabitants of our Los Angeles Basin.

Thank you.

The CHAIRMAN. That is an excellent statement, Mrs. Atkisson. May I ask: Has the California Federation of Women's Clubs passed any resolutions about tax reduction?

Mrs. ATKISSON. To the best of my knowledge, we have not passed any resolutions about tax reduction.

The CHAIRMAN. That was a facetious question, and I want to make it very plain to you that the total amount of our budget dedicated to what I regard as building America, whether it is in the field of conservation or in the field of water projects, is such a small part of it that we can well afford to do it and not regard it as a conscious addition to the total cost.

I have said that many times. People appear, and sometimes chamber of commerce people come in and testify before these committees urging the appropriation of funds for particular purposes, whereas, in general, they have lambasted Congress pretty hard about tax reduction.

I think what we have to do is to put the emphasis on the major items in the field of tax reduction. I regard the preservation of our natural resources and the few things we do for America as little enough for the taxpayers to get out of their taxes.

Mr. Sisk, do you have any questions?

Mr. SISK. I merely want to commend Mrs. Atkisson on a very good statement and the work her group is doing. I happen to know in my own area the interest of the Federation of Women's Clubs, and they are doing an outstanding job.

Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Rhodes.

Mr. RHODES. I just want to commend Mrs. Atkisson also for a very fine statement. I was a little shocked when you said it would take 450 years to reforest these burned areas. By that I presume you mean with ponderosa pine and long-growing plants like that, and not with the brush which was probably on there before it burned over.

Mrs. ATKISSON. I had reference there to the appropriations. In 1956, the annual Federal appropriation for reforestation was only $75,000 for the entire State.

Mr. RHODES. I was thinking of the 450 years it was going to take to reforest.

Mrs. ATKISSON. There are approximately 4 million acres of land in California that are in need of reforestation. I believe that is exclusive of brushland. I believe that includes lands capable of growing trees. I am not an authority. I could not be sure.

Mr. RHODES. Thank you.

The CHAIRMAN. Off the record.

(Discussion off the record.)

The CHAIRMAN. Thank you very much, Mrs. Atkisson.

Mr. Jerry Foote, I understand you represent the Sierra Club, is that right?

Mr. FOOTE. Yes, sir.

The CHAIRMAN. Would you state your full name, your address, and what particular Sierra Club you represent, if any, or whether you represent the entire organization.

STATEMENT OF JERRY FOOTE, LOS ANGELES, CALIF., REPRESENTING THE SIERRA CLUB

Mr. FOOTE. I am Jerry Foote, and I represent the Sierra Club, a conservation club of about 12,000 members. I am speaking for the board of directors, which asked me to appear at this committee meeting. I am also appearing here at the courtesy of the Los Angeles School District, who allowed me to come off this afternoon.

The CHAIRMAN. Express to them our appreciation; will you, please?

Mr. FOOTE. Thank you. Some months ago, and for some years, it has been the thought of the different individual citizens and many of the public officials that southern California chaparral could possibly be burned off and replaced with grass. Although this idea has not been current in the last few months, it was brought up some time back and the Sierra Club was somewhat concerned over the matter, felt they should take a completely objective study on this. So we have written letters, asking for information, to people who are authorities on this matter—college professors, wildlife people, and so on.

The 2-page sheet I have passed out is a summary of the findings and extracts from the letters about the nature of chaparral itself, pointing out that chaparral itself is here because of a long period of evolution; has been one of the best adapted plants for surviving fire; and in southern California the chaparral is much different than it might be in other places in California and also in other places of the United States.

The next section takes up the nature of grass and its occurrences.

None of these authorities have found any grass growing in any abundance on the heavily sloped hills, nor have they found any grass that is now known that could be placed on these hills.

The story as to the prediction of the outcome of controlled burns: Nobody can say. To the best of our knowledge there are absolutely no experiments that have been performed at the present time to check the long-range outcome of burning, replacing with grass from the point of erosion, soil control, reforestation itself, or redressing. Some grasses have been proposed for this, including rye grasses, but to the knowledge of most of our people the rye grasses will not grow in southern California all year round under the normal rainfall we have here.

Now, supposing the case that chaparral was replaced with grass, how would the grass survive?

Approximately 90 percent of our chaparral species are the type that either resprout after a forest fire or that, due to the fire, the seeds are more easily germinated.

The chaparral sprouts may rise 1 to 3 feet in a single season, depending somewhat on the weather conditions, and may again replace the area and probably take over the grass.

These are just findings, as I say, from men who are authorities in direct experiments.

No direct experiments have been made on this matter of the long-range plan of replacing grass for the chaparral.

The Sierra Club, therefore, respectfully submits to the committee that before any large-scale attempts at replacement of chaparral by grass on southern California hillsides are made, that carefully controlled experiments under various conditions be carried out showing the feasibility of such practice in the long run.

At the bottom of the sheet, you will see the names of the half dozen contributors.

Thank you very much for your attention. I will be happy to answer any questions, if I can.

(The statement submitted by Mr. Foote follows:)

CHAPARRAL VERSUS GRASS

As there have been no experiments of controlled burning in southern California for the purpose of replacing chaparral with grass and specifically for studying the long-range effects on erosion, water percolation, and comparative fire hazards, the following statements are submitted:

I. THE NATURE OF CHAPARRAL AND ITS OCCURRENCE

"I think it is well for us to remember that the type of vegetation in a given area is usually there as the result of a long period of evolution. The result is that the vegetation is one adapted to the local conditions. Our chaparral contains a group of mostly shrubby plants with certain shape and leaf structure that enable them to withstand rainless summers."—Munz.

"The chaparral is on the mountains of southern California because it is capable of growth under the edaphic and climatic conditions that exist, and because it can survive fire."—Hellmers.

"The case with chaparral and watershed is quite different in your northern California country than with us in southern California. Our slopes, friable and steep, erodible soil, and torrential, semiarid type rainfall, create special conditions. Consequently, with us, the chaparral seems to answer better the year-round need for protection and stabilized water production than any known grass or other type of vegetation."—Taylor.

II. THE NATURE OF GRASS AND ITS OCCURRENCES

"The only grass that can withstand such conditions (rainless summers) are small annuals or the introduced weeds like wild oats and brome grass, and they for the most part have to grow on less steep and less barren slope."—Munz.

"Grass is an excellent stabilizer of soils on moderate slopes if ungrazed. Moderate grazing will greatly reduce the ability of the grass to hold the soil and heavy grazing will practically destroy this ability. Many of our hill lands are incapable of sustaining a good grass cover under light grazing. These areas should be left in the native brush cover."—Youngner.

"Because of shallow soils, sandy texture, and low nutritional levels it is not possible to maintain grass naturally on much of the San Gabriel Range, even if it were desirable. I do not believe we could maintain a grass cover on most of the present chaparral area without a strictly artificial and most expensive system (terrace, fertilize, and irrigate). Furthermore, I am not sure that a grass cover would solve all our water and fire problems."—Hellmers.

III. LACK OF EXPERIMENTATION IN CONTROLLED BURNING

"To date there has been so little real work of any scope in determining the feasibility of prescribed or controlled burning as a long-range fire management practice or its influence of present range-management methods. There has been a great deal of work by individual universities and governmental agencies but this has, for the most part, been done on small areas, with questionable or no control elements, and with no positive conclusions reached."—Carithers.

IV. WHAT ARE THE PREDICTIONS AND EXPECTATIONS OF CONTROLLED BURNING?

"Individual hillsides must be studied to determine the desirability of grass establishment. If this is done I am sure that it will be readily seen that many areas should not be touched. Many hills will be subject to severe soil erosion if the natural vegetation is removed and the attempt made to establish grass."—Youngner.

Will the grass survive? This might be checked by "planting grass in sample plots of dry chaparral land which are to be given no extra water and to let all observe what happens over a period of several years. The results are likely to be obvious at the end of a single season, barring a winter of very heavy rainfall."—Benson.

Will rye grass work? "We have had rye grass growing out of cultivation in this State for at least a hundred years. They are (rye grasses considered collectively) locally abundant only in the areas, for example in northern California, where the rainfall is heavy and the land is more or less meadowlike. The rye grasses with which I am familiar have shown no evidence at all of being able to survive in the chaparral areas."—Benson.

If the grass did survive several seasons: "Many species (of chaparral) sprout after the fire, while others produce seed that germinate rapidly after being stimulated by fire."—Hellmers.

"The (chaparral) sprouts may rise 1 to 3 feet in a single season, depending somewhat on the weather conditions."—Benson.

V. IN CONCLUSION, INVESTIGATION WILL PROBABLY SHOW

"* * * that, under the conditions obtaining in southern California, no known grass, nor any known herb, can take the place of the chaparral community of vegetation as a protector of our mountain sides, preventer of soil erosion and floods, and promoter of water percolation into our subterranean reservoirs."—Taylor.

As a result of the controversy regarding controlled burning and the replacement of chaparral by grass in various parts of the State, and in view of the statements presented, the following resolution is respectfully submitted by the Sierra Club:

That before any large-scale attempts at replacement of chaparral by grass on southern California hillsides are made, that carefully controlled experiments under various conditions be carried out showing the feasibility of such practice in the long run.

Respectfully submitted.

EDWARD PETERSON,
JERRY FOOTE,
Sierra Club.

The above statements were extracted from letters from the following contributors:

Philip A. Munz, director, Rancho Santa Ana Botanic Gardens.

Henry Hellmers, plant physiologist, USDA, California Range and Experiment Station, California Institute of Technology.

Walter Taylor, retired, Fish and Wildlife official, Department of the Interior, formerly lecturer, Claremont Graduate School.

Victor B. Youngner, assistant professor, Agriculture Experiment Station, University of California at Los Angeles.

J. F. Carithers, assistant western representative, National Parks Association.

Lyman Benson, department of botany, Pomona College.

The CHAIRMAN. We very much appreciate your statement, Mr. Foote.

The other day over in Blythe or some place while this committee was out on the road someone came up and told me that the Sierra Club had published some statement to the effect it was my position that I wanted to burn all the brush off of all the public lands of the United States, or something like that. I told this party that was absolutely bunk. Do you know anything about such a statement made by the Sierra Club?

Mr. FOOTE. No, I do not. I know about September 28 there was a statement made by yourself in the newspapers. I think it was perhaps condensed, perhaps quoted out of context. And most every one I spoke to did feel you were more or less in favor of the possibility of burning off the chaparral and the grass, but the Sierra Club did not make such a statement.

The CHAIRMAN. I want correct that impression if it exists. I said in some instances, as I have said here a number of times, that brush burning could be used successfully. But I have always had grave misgivings about trying to burn the brush on these slopes where you immediately bring down debris, boulders, and everything else, right into the bottom of the canyon.

So my position on brush burning is that in certain areas I think perhaps it might work. I believe that the program carried on by the State forestry service is a good one, that is, they ought to try it out.

Back in 1943 when I was a member of the State senate I helped to get the first appropriation for experimental controlled burning, and that was as the genesis of the program which the State forest service is now carrying out. But to make a blanket statement that brush burning will do in every instance is not correct and does not correctly reflect my views in the matter. So I want to be sure that my friends in the Sierra Club—and by the way, they are my friends—are not misled on that point.

Mr. Sisk, do you have any questions?

Mr. SISK. I simply want to say that I agree very heartily with the statement made by Mr. Foote for the Sierra Club, because I think the thing he brings out in here is the desire for research and experimental work to be done, which is the very thing I have been advocating and that many others have been.

I, too, would like to make it completely clear that, irrespective of how many questions may have sounded, I am certainly not one of these people that believe in wholesale burning, but I do think that every phase of this thing should be researched, should be explored, should be interpreted in an effort to arrive at an answer.

Of course, in my own area I think we have had some very successful experiments with controlled burns on isolated and specific areas. I realize the topography here is much different and that wholesale burning, of course, would be out of the question.

The only thing I have been interested in is seeing some research, seeing a little vision used on the part of the Forest Service to do some research and to make some experiments in specific areas, specific spots, where the topography and soil conditions might be right.

I certainly want to commend you on your statement, Mr. Foote.

Mr. FOOTE. I might also say in connection with the original statement that it has not just been public officials being misquoted, but we have such a terrific influx of people into the State that a lot of them have the same feeling, and although it cannot do anything about it, there should be occasions that public statements could be made. I think it would help a lot in having the new southern California arrivals understand our situation better.

The CHAIRMAN. The gentleman from Arizona, Mr. Rhodes.

Mr. RHODES. I have no questions, except to thank the gentleman for being here to present the views of the Sierra Club, and also to say that

I certainly agree that you have to do a lot of experimentation and be pretty sure before you start upsetting the balance of nature.

The CHAIRMAN. Thank you very much, Mr. Foote, for your statement. We appreciate it.

Is Mr. Walter H. Janssen in the room?

Mr. JANSSEN. Yes.

The CHAIRMAN. From Santa Barbara?

Mr. JANSSEN. That is correct.

The CHAIRMAN. Do you desire to make a statement at this time? Do you have a prepared statement?

Mr. JANSSEN. My statement, as you will see, if you will bear with me, is strictly off the cuff and is in a series of questions. If it would be permitted by this committee, if it will bear with me, I think I can explain to you why it was done this way.

The CHAIRMAN. You may proceed.

STATEMENT OF WALTER H. JANSSEN, SANTA BARBARA, CALIF.

Mr. JANSSEN. I know this is not regular procedure for this, but I would like to read it just as it is.

Have you ever visited any of the smaller and poorly equipped stations like the station at Cranston, 6 miles from Hemet, Calif.? This station was condemned 25 years ago as unfit for living. Yet men are required to live in these houses and pay $25 a month rent. What man of pride of his job would consider living under such conditions, also being charged for his utilities, when they are furnished by the Government free of charge; also Vista Grande in the same district?

Why is a Forest Service employee called a civil-service employee when there is no examination for an appointment? All he has to be is liked by the clique?

Why is it that a district ranger can ask the Selective Service Board to exempt a man from service when he is not a civil-service employee and get him draft exempt?

Why is a man who while fighting a fire becomes trapped and is not allowed to protect himself and his crew in preference to property or spreading the fire?

This—I would ad lib a little bit, sir—I hope you ask me about.

Is it known that men working for the United States Forest Service have started forest fires and I do not mean backfires but deliberate arson?

Why is it that after the announcement of this committee hearing the employees of the Forest Service were told not to talk to anyone about it and to keep their mouth shut?

I was told by an assistant forest supervisor, I will name on request, that I would never be hired back in the Los Padres National Forest because I knew too much.

I know the answer to all of these questions but they cannot be answered in 5 minutes. It took me 4 years to see and understand what was wrong.

The CHAIRMAN. I assume, Mr. Janssen, you are a former employee?

Mr. JANSSEN. Yes, sir, I am.

The CHAIRMAN. For what period of time did you work for the Forest Service?

Mr. JANSSEN. I was on just exactly what was referred to here as a temporary appointment—I can stand corrected—what they call a 180-day appointment. It consisted of just the fire season was all.

The CHAIRMAN. What date was that?

Mr. JANSSEN. I was employed in 1946 at Los Padres, in 1948 in Los Padres, and in 1951 at Los Padres, and then San Bernardino in 1952 and 1953. I can stand corrected.

The CHAIRMAN. Do you have any questions, Mr. Sisk?

Mr. SISK. No questions, Mr. Chairman.

The CHAIRMAN. Any questions, Mr. Rhodes?

Mr. RHODES. Nothing, except if this gentleman can substantiate what he says here, he should be before a Federal grand jury instead of a committee of the House of Representatives.

The CHAIRMAN. I just suggest, Mr. Janssen, the committee is not the appropriate place for the complaint you make about the Forest Service. However, Mr. Connaughton, will you prepare a memorandum for the committee in response to the statements made by Mr. Janssen.

Mr. CONNAUGHTON. I believe it would be necessary for us to obtain some additional information, and I am sure Mr. Janssen will be glad to supply it.

Mr. JANSSEN. I would be more than happy to cooperate.

The CHAIRMAN. Thank you very much, Mr. Connaughton.

Thank you, Mr. Janssen.

Mr. JANSSEN. Thank you, sir.

(Subsequently the following letter was received from Forest Service:)

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., December 30, 1957.

HON. CLAIR ENGLE,
Chairman, Committee on Interior and Insular Affairs,
House of Representatives.

DEAR CONGRESSMAN ENGLE: At the fire-control hearing held by your committee in Los Angeles October 8 and 9, Mr. Walter H. Janssen raised certain questions which you asked Mr. Connaughton to investigate. Our investigation included an interview with Mr. Janssen to help clarify the questions. The questions with the results of our investigation are as follows:

(1) "Have you ever visited any of the smaller and poorly equipped stations like the station at Cranston, 6 miles from Hemet, Calif.? This station was condemned 25 years ago as unfit for living. Yet men are required to live in these houses and pay $25 a month rent. What man of pride of his job would consider living under such conditions, also being charged for his utilities, when they are furnished by the Government free of charge; also Vista Grande in the same district?"

The two ranger stations in question are old, having been built in 1918. They leave much to be desired. However, both have been maintained and are livable. Charges for them and utilities are made according to standard procedures. The Forest Service recognizes that housing conditions are not satisfactory and is engaged in a program to better them. It will, of course, require many years before all the unsatisfactory housing situations are corrected. The more urgent cases are necessarily given the highest priority under the current program.

(2) "Why is a Forest Service employee called a civil-service employee when there is no examination for an appointment? All he has to be is liked by the clique?"

Janssen apparently believes the Forest Service plays favorites. When he was interviewed, his statements indicated that he had long nursed a strong desire to be a permanent employee of the Forest Service. He was employed from time to time on a seasonal or temporary basis. However, his work record,

Army record, arrest record, and social behavior are not such as to make him a desirable regular employee.

Contrary to the implications of his question, civil-service examinations are announced and held in the usual manner for the positions concerned.

(3) "Why is it that a district ranger can ask the Selective Service Board to exempt a man from service when he is not a civil-service employee and get him draft exempt?"

Investigation revealed that Janssen was mistaken in his belief that the Forest Service had requested deferment for an employee. The man he apparently had in mind was classified as 4–F by the draft board because of polio.

(4) "Why is a man who while fighting a fire becomes trapped and is not allowed to protect himself and his crew in preference to property or spreading the fire?"

Investigators were unable to identify just what Janssen was referring to in this allegation. It apparently stems from criticism he received as a result of an action he initiated on the Wheeler Springs fire on the Ojai district of the Los Padres National Forest in 1948. On that fire he was relieved of charge of a small crew and reassigned to other work because his superior believed he had shown poor judgment in the actions he had taken. Since Janssen could not remember the name of his superior at that time it was not possible to ascertain further facts in the case.

Fighting a forest fire is hazardous work. The Forest Service tries to place the best qualified and experienced personnel in charge of fire fighting and expects the fire fighters to follow this leadership. Protection of human life is always given priority over protection of property.

(5) "Is it known that men working for the United States Forest Service have started forest fires and I do not mean backfires but deliberate arson?"

This refers to an incident associated with the Alvin Meadows fire on the San Jacinto district of the San Bernardino National Forest in September 1953. It seems that there may be truth to this allegation. The original investigation indicated that the fire was started by deer hunters and it was so recorded. Investigation since the hearing indicates that this fire may have been deliberately set by a member or members of a Forest Service short-term fire crew. Forest Service Criminal Investigator Ellwood H. Stone has been instructed to make a complete investigation of this allegation and the rumors connected therewith.

(6) "Why is it that after the announcement of this committee hearing the employees of the Forest Service were told not to talk to anyone about it and to keep their mouth shut?"

Investigators could find no evidence of anyone's having in any way tried to control Forest Service employees in expressing themselves on this matter.

(7) "I was told by an assistant forest supervisor I will name on request, that I would never be hired back in the Los Padres National Forest because I knew too much."

Our interview with Mr. Janssen disclosed that the statement referred to was supposedly made by a man who was a staff assistant on the Los Padres National Forest in 1949 and 1950. He went into the Navy in 1950 and has remained in that service. He was not available for interview. Our investigation failed to develop any substance in this question.

Very truly yours,

RICHARD E. MCARDLE, *Chief.*
By EDWARD P. CLIFF.

The CHAIRMAN. I have now called the list of those who submitted their names to the committee staff for the purpose of presenting testimony. In addition, certain parties have submitted statements that they desire to have entered in the record. Among those is a statement from the California Cattlemen's Association, 659 Monadnock Building, 681 Market Street, San Francisco, Calif.

Without objection, the statement will be made a part of the record.

Also a statement by Mr. Edward N. Munns, 1630 Garnet Lane, Concord, Calif., regarding Forest Service responsibility for fire protection.

Without objection, the statement will be made a part of the record.

In addition, a statement from Judge Acton M. Cleveland, Camptonville, Yuba County, Calif.

Without objection, Judge Cleveland's statement will be made a part of the record.

In addition, Mr. Roland Ross, of the Desmount Club, desires to submit a statement, and, without objection, it will be included in the record.

(The statements referred to follow:)

STATEMENT OF JUDGE ACTON M. CLEVELAND, CAMPTONVILLE, YUBA COUNTY, CALIF., CONCERNING FOREST SERVICE POLICY AND RESPONSIBILITIES FOR PROTECTION AGAINST FOREST AND BRUSH FIRES IN CALIFORNIA

In my opinion the policy which has been put forth by the Forest Service since its inception is responsible for the condition of the forests and the fire situation as it exists today. The policy has been now for over 50 years, to permit no fires in the forests and to allow a jungle of underbrush, useless vegetation, and trash to accumulate in our forests during this period of time.

My opinion and this statement is formed from my personal observation of this condition for the past 50 years. Anyone knows that whatever premises one is in charge of, it must be cleaned up and taken care of. If one owns a lot or piece of property in a city and does not take proper care of it, and allows a fire hazard to become prevalent, the city will take care of it for the owner and make him pay the bill. Every property owner removes the fire hazard from his own lot, yard, or farm, or destruction would follow.

I have lived in the mountains within a heavy forest my entire lifetime. When I was a boy, I could walk freely throughout the forests in any direction just as though walking in a park. In those days the natives, and before them the Indians, kept the forests clean. Fifty years ago the Forest Service came into being and began their policy of not permitting any fire in the forests, letting the trash collect in our forests and today we have a veritable jungle, as a result, where one could walk freely, now a rabbit cannot crawl through.

My family has been in business in this community for 102 years. When my grandfather was a young man he used to run a pack train through these mountains for a radius of around 15 miles. On his last trip out of the mountains in the fall he would set fire along the trails as he came out. There were Indians in the area at that and previous times and they followed the same practice. This was not only done by my grandfather and the Indians but by everyone who lived in the forests. In fact, nature even took care of it before the time of man, and afterward, with lightning fires throughout the forests. This was done every year and all that there was to burn was whatever debris might have accumulated from the year before. This did not harm nor destroy the timber, neither did it leave the terrain subject to erosion. This may be evidenced now by observing that most of the virgin timber still in the forest shows a slight charring on the bark which in no way harmed the tree.

This practice not only kept the trash out of the forests but also furnished grazing land for thousands of cattle. Today in our locality there is practically no grazing because the brush has taken over and there is no room for grass or suitable cattle feed.

When I was a boy almost everyone had large gardens, and it was unheard of for deer to come into town or one's premises and eat the garden. For the past many years the destruction of gardens and crops by deer has become such a problem that the department of fish and game had to become concerned about it. This is because of this brush condition in the forests, food for deer is scarce and they will seek it wherever they may find it.

The most deplorable and alarming situation which the Forest Service policy has contributed to is the present water situation. Year by year our water source and supply is diminishing. The water supply for the town of Camptonville comes from a small running stream. Fifty years ago there was three times as much water running in it as there is today, and I predict that unless something is done to change the Forest Service policy within the next 25 years this stream will entirely dry up during the summer season and the community will be out of water. This condition is universal throughout the mountains.

This water situation has not been caused or primarily effected by the weather. Our annual rainfall has remained about the same during all this time; 65 inches being the average annual precipitation, with the maximum being 109 inches, and the minimum, in 1924 and 1931, 2 of the driest years during the past 50, around 24 inches. For the past many years, due to the Forest Service policy,

the ground has become covered with a thick mattresslike covering of pine needles, leaves, and other debris, in many places a foot deep. How can rainfall or snow penetrate into the ground through this thatched roof? Further, when we have a snowstorm, the snow falls on top of all the brush now accumulated in our forests, and instead of melting into the ground as it naturally should, it lies on top of the brush, with a circulation of air under it, and thus most of the moisture contained therein goes off in evaporation into the air rather than into the ground where it formerly used to go. On a mountain opposite our town the P. G. & E. Co. has a powerline going directly over it. It can be observed every time that we have a snowstorm, as the snow leaves, it will soon disappear on both sides of the pole line right-of-way, where it had fallen on debris and brush, whereas on the right-of-way, where it fell upon the ground, there will be a white ribbon over the mountain for days after it has gone from both sides, demonstrating that on the right-of-way it fell on the ground and melted into the ground, but on both sides it fell on brush and most of it evaporated into the air.

With rainfall, how can this water penetrate into the earth, when it falls on this heavy laden thatched roof which now covers our earth's surface? Most of it runs off into the streams and back to the ocean.

The most astounding depletion of our water supply is caused by the amount that the brush and other jungle vegetation uses up for its growth, and this is what is foremost in destroying our springs and water sources today.

This fact has been proven many times. The worst fire year we ever witnessed in this area took place during the dry season in 1924, during which a bad fire raged through the forests about 5 miles below this town, taking everything in its path. Within a few weeks after the fire was out and the earth had cooled off, water started to flow in several ravines in the area which had been dry for years, demonstrating that the brush and useless vegetation had been consuming water that formerly had flowed in those ravines.

Further, a few years ago, the area adjacent to and above the water supply for this town was logged off. Along with the timber which was cut, the bull-dozers tore up all the jungle of brush and vegetation along the creek sides. A short time after this was done, the water source increased very noticeably with just this small amount of cleaning out the jungle.

When the forests were kept clean and burned over every year or two there could be no bad fires because there was not the bulk of material to burn. At this date, after the Forest Service has permitted this jungle to accumulate for 50 years, whenever a fire does get a good start, there is no stopping it and it will take everything in its path, leaving devastation, and an ash-covered terrain which as soon as heavy storms come will give way to erosion.

When I was a boy I used to be out in the forests when the manmade fires were burning, and if one of them became a little too hot or should be headed in a direction that might endanger someone's place, the neighbors would get together, go ahead half a mile or some safe distance, backfire and keep it under perfect control. I understand that the present Forest Service policy will not permit long-distance backfiring. This is an error and by trying to stop a fire at close range, especially with all the trash that the forests contain today, only further destruction will result, possibly has been and easily could be the cause of loss of life. A good forest fire today is an inferno and should be dealt with at safe distances.

I understand that the Forest Service has spent considerable money in the eradication of gooseberry plants because of some condition they claim affects certain trees, and also that they had a campaign to eliminate porcupines from the forests because of their destroying trees in the forest. (Only a short time ago this animal was protected by Federal law because it was claimed that it was the only animal man could kill without a weapon and use for food.) There have been gooseberry bushes and porcupines for the past generations. How come they had not ruined our forests prior to the time that the Forest Service came into existence?

I understand that the Forest Service claims that the forest is not producing young pine trees as they should because the gray squirrels are eating up the seed (pine nuts). If this be so, this is also a fallacy. When I was a boy gray squirrels were so thick that anyone could go out and within a short time shoot 10 to 15 of them; the woods were full of squirrels, and the pine trees flourished. The reason why pine trees may not be growing according to the specifications of the Forest Service is easy to answer. How can one expect young trees to come up when the ground has a covering of trash over it to such a degree that the

seed or pine nuts can never reach the ground in order to germinate and grow? I can show many places adjacent to this town where the ground is clean, along road rights-of-way, etc., where the young pine trees are coming up by the thousand, which will be the case in any location where the seed reaches the ground.

I am informed that this Forest Service policy is practiced in a uniform manner throughout the United States. I am not familiar with forest conditions in other States; my comments concern California. I do not believe that the same policy could ever work satisfactorily throughout the entire country as each locality has different local conditions. There may be some places in the United States where the creation of brush on mountains may be beneficial.

For many years the California State Department of Forestry followed the same policy as the Forest Service, but in recent years have changed their policy and now favor controlled burning. This is a step toward correction but one must realize that now, after 50 years of cultivating a forest of rubbish, debris, and useless vegetation, it is going to be a major project to ever get the forests in the beautiful condition they were in before the Forest Service was started, but it is the only way our forests and most precious water sources will ever be preserved.

The Forest Service is a very necessary part of our Government; our forests must be protected, administered, and preserved. My statement is not one of condemnation, but is a plea for a change in policy.

I further wish to state that I have no criticism against the personnel of the Forest Service. These men have a job the same as the rest of us and are doing their best to carry out their orders. They are fine men and my best friends; they have always been courteous and cooperative. My criticism is of the policy which originates at and comes from Washington.

This is a very vital issue and I trust that this committee will give it full consideration and be able to bring about a change in policy before it is too late.

STATEMENT OF CALIFORNIA CATTLEMEN'S ASSOCIATION

SAN FRANCISCO, CALIF., *October 4, 1957.*

To: Hon. Clair Engle, Chairman, Committee on Interior and Insular Affairs.
From: California Cattlemen's Association.
Subject: Hearing on the United States Forest Service.

The California Cattlemen's Association submits the following brief to the members of the Committee on Interior and Insular Affairs of the House of Representatives meeting in Courthouse Room No. 9, United States Post Office and Courthouse Building, Los Angeles, Calif., on October 8 and 9, 1957, to receive testimony on certain aspects of the United States Forest Service.

GENERAL

The California Cattlemen's Association is limiting its statement to the practical question of brush eradication on the United States Forest Service lands. Others have prepared statements outlining the results of experiments in the eradication of brush on public lands, and its effects on water conservation, fire hazards, and range improvement.

BRUSH HAS BECOME A MENACE

The brush and undergrowth covering much of the Forest Service land has become a menace to the economy and the people of California. This debris and undergrowth, when ignited under present conditions, would create uncontrollable fires destroying everything in its path, laying waste to valuable timber and other natural resources.

The United States Forest Service has to some degree in the past, followed a negative policy of guardian of brushlands within its boundaries, rather than a progressive program of research for eradication. There have been encouraging signs during the last few years that the Forest Service is becoming aware that brush is making firetraps and tinderboxes of our forests.

CATTLEMEN FAVOR BRUSH REMOVAL

The California Cattlemen's Association and other livestock groups, encouraged by the Forest Service considering some type of control-burning demonstrations, feel that it should hasten a control-burn program for the national forests in California.

The cattlemen and other livestock producers are of the opinion that every day such a program is held in abeyance the fire hazards become greater and greater. The rapid growth and movement of our population away from the large cities is already beginning to complicate the problem of brush removal on forest lands.

BRUSH REMOVAL ON PRIVATE LANDS

There are probably around 15 million acres of brush-covered deeded land in California. The brush on private lands was taking more and more acreage out of grazing and was becoming such a fire hazard that the livestock people asked the State legislature to pass legislation to provide for the issuance of permits for controlled burning of brush-covered lands. The 1945 legislature amended the Public Resources Code authorizing the California division of forestry to initiate a range-improvement program for the eliminating of brush.

The range-improvement program consists primarily of the range-improvement projects of ranchers, where land is cleared by controlled burning under permits administered by the division of forestry. Controlled-burning projects and related range-improvement activity are carried on by private individuals and groups on lands under their ownership or legal control.

The division of forestry administers the permits for controlled burning for the protection of public interest, it inspects areas proposed for burning, provides advisory service as to the precautions to be taken during burning, and issues the permits. The division provides standby crews for protection of adjacent property during burning, but is not authorized to do the actual controlled burning for the ranchers.

Preparation for the controlled burn is done by the ranchers themselves. They prepare the firelines and furnish a large amount of equipment for use in control of the fire. Large numbers of ranchers participate in a single burn to assist in keeping the burn under control.

MORE THAN 1 MILLION ACRES BURNED UNDER PERMIT

The division of forestry issued 4,793 permits from 1945 to 1956 and 1,337,646 acres of brush lands were burned under these permits. There were only a little more than 117,000 acres burned by escape fires which reflects the effectiveness of controlled burning.

FROM BRUSH TO GRASS

Ranchers reseeded more than 400,000 acres of the acres burned under permit in order to increase the forage capacity of particular areas. Aircraft was used for seeding in approximately half of the cases.

CONCLUSION

Controlled burning returns brush-covered lands to forage for livestock and wildlife. Experiments have shown that brush eradication conserves water. Controlled burning on private lands reduces fire hazards and destruction of natural resources.

Cattlemen feel that the Forest Service should initiate an aggressive brush clearance and reseeding program as quickly as possible to prevent further destruction of property and natural resources.

Respectfully submitted.

J. EDGAR DICK,
Secretary, California Cattlemen's Association.

STATEMENT OF EDWARD N. MUNNS, CONCORD, CALIF.

To: Subcommittee, House Interior and Insular Affairs.
Subject: Forest Service responsibilities for fire protection.

Mr. Chairman, my name is Edward N. Munns. I am a forester with 40 years' experience, mostly in research administration in the United States Forest Service, and 2 years with the California State forester. I spent 7 years on the Angeles National Forest, which then included the present San Bernardino Forest. As the only technical forester then in southern California, I was involved in many activities in all national forests of the area, from Monterey to the Mexican border. I have written numerous technical papers on the chaparral region. I have been on fires in every part of this area. For more than 12 years, I was in charge of forest-fire research in the Forest Service.

SUMMARY

Forest Service responsibilities for protection against fire in southern California have never been adequately met. They have not been met in the past, they are not being met today. This failure is, in large measure, due to the failure of the public to realize the extent and seriousness of the fire problem locally. Much is due to lack of financial support. A part is due to organizational failures. A part is due to failure of various Secretaries of the Department of Agriculture to understand the nature of the problem. A part is due to inadequate research. By and large, most failures stem from a lack of money.

Some remedies, here proposed, can be achieved within existing legislation. Others require more authority. Some affect the internal structure of the forest, others are local in character. These remedies are:

1. A professional fire-control organization is needed.
2. Training in fire-control methods is basic.
3. Weather Bureau aid is essential.
4. Fire-control facilities need strengthening.
5. Fuel-hazard reduction is indispensable.
6. Fire-control research is vital.
7. A watershed conservation committee is desirable.
8. Adequate fire control requires adequate funds.

1. A PROFESSIONAL FIRE-CONTROL ORGANIZATION

The Forest Service should develop a professional forest-fire-control organization. This could be a branch with an assistant forester in charge in Washington responsible to the Chief directly, and handling all phases of fire activity on national forests and in cooperation with the States. It would function regionally but with added regions to those now established; one of these would be in southern California.

A professional fire-control unit would give incentive to entering upon this activity as a career. It would provide opportunities for men with ability and training to remain in the activity instead of being switched from one job to another to give him due promotion. It would permit development of highly skilled technicians in supervisory positions involving fire control. It would permit development and retention of a hard core of well-trained subprofessional men who could supervise fire-fighting crews with minimal instruction in emergencies.

Legislation and funds are required. The organization needs legislative direction, though it could be developed under the present framework of the Forest Service. It would provide for a technical staff in charge of all fire activities within the national forests and in cooperation with the States and other political units, for the lands under State and local responsibilities. It would provide for subprofessional workers with wage rates above those paid for comparable activities in the Service. Such rates are needed to attract and hold talented personnel. Because of the arduous and hazardous nature of the work, retirement should be possible at age 50, and compulsory at 60, and with appropriate retirement benefits.

Funds will be needed. Subprofessionals and personnel in standby crews should be maintained on a yearlong basis. At present, personnel is released each year at the close of the fire season. Reemployment of desirable personnel is not too successful. When it is, it is usually the less efficient who are obtainable. This is costly in time, effort, and money. Employment of this personnel on other activities would preserve the organization during the nonfire season, would attract desirable workers, and would enhance the efficiency of the fire-control unit.

2. TRAINING IN FIRE CONTROL

Fire control is often compared with warfare. For war, training is essential for everyone. In defense agencies, there is a War College for top brass, continuing schools for staff and line officers, special courses for the noncommissioned personnel, and war games and maneuvers for troops. In fire control, no such training is provided. Mostly, experience is the teacher.

Young foresters graduate from forest schools almost without understanding or special instruction in the subject. There is not a single textbook on the subject. Few professors have had any experience in fire. What training in fire the new forester gets is at infrequent camps or on fires. Consequently, he tends

to repeat the same mistakes as he is transferred from one unit to another, from one locality to another.

There is some training in the Forest Service, both of staff officers and of standby crews. This is limited both as to time and amount. It does not get into the upper levels of the organization. It is mostly based on experience, and deals with physical things. There is little understanding of the laws of combustion, knowledge of fuels, or basic education in fire behavior or rate of spread of fires under the varied conditions of terrain and weather. There is little on meteorology or other influencing factors.

Training is highly localized; it is irregular in application; it is not continuous or uniform. Staff officers may function for years without any special training. Refresher courses are years apart. Trainees are not given formal examinations, nor are they screened as to ability or understanding. Should the individual do poorly in a course, he does not repeat it till proficient; he remains on the same job; he makes the same mistakes on actual fires as he does in the course.

Systematic training of all personnel engaged in fire control is needed. This training should adequately cover the subject Such training could be given within legislative authority now available. However, when providing legislative authority for a branch of fire control, the legislation also should grant authority for a series of "fire-control-training camps." It should be required that all personnel engaged in the activity, from the top down, would be given vocational and technical training in the art and practice of fire control with required refresher courses at periods of not less than 3 years. Attendance would be compulsory and at public expense. Those failing tests would be required to repeat, or be dropped, or be transferred to other activities in the Forest Service.

Legislation might spell out the number of such schools required nationwide, with one specified for southern California. It should also grant authority for participation in the training to other public agencies on a cooperative basis. Participation by other Federal agencies should require transfer of funds, and is to be furnished other political units at cost, or on a limited-fee basis. Limited employment of consultants and specialists outside the Federal service should be provided.

3. WEATHER BUREAU AID ESSENTIAL

The Weather Bureau does not participate sufficiently in the fire-control program. Under the Forest Research Act of 1928, close cooperation between the Weather Bureau and the Forest Service was indicated. After some years, the Weather Bureau failed to make budgetary requests for the activity, and the Forest Service failed to request contribution of the service. The transfer of the Weather Bureau to the Department of Commerce widened the breach.

Under the act, the Bureau carried on research in forest-fire weather and established a mobile weather-prediction station for use on large fires. Comparable research and predictions should be undertaken. Present forecasting service is not localized.

Basic authority is, perhaps, ample for most cooperation in research and prediction, but may need amplification for participation in training programs and for more intensified local forecasting. Funds would be required, and the Forest Service should recommend the kind and extent of the services required, so that the Weather Bureau may include estimates of funds needed in its annual budget.

The alternate to Weather Bureau cooperation would be employment of experts in the Forest Service.

4. SURVEY OF FIRE-CONTROL FACILITIES AND NEEDS

A survey of fire-control needs is imperative. Such a survey should outline, in complete fashion, the present situation as to the facilities now available, and those needed to bring present means up to a desirable standard. The survey should apply not only to national forests, but to all public lands, and to all other lands, privately owned, in need of fire protection. The survey should present a 5-year plan, and show annual increments.

The survey should cover the 12 counties in the chaparral region of southern California. These include San Diego, Imperial, Riverside, Orange, Los Angeles, San Bernardino, Kern, Ventura, Santa Barbara, San Luis, San Benito,

and Monterey. It would cover the national forests of the region, except for the Sequoia in the southern Sierras.

The survey should be a cooperative one in which all counties would share to the extent of their interests, either directly or through the State forester, for lands other than the national ones. Unless he should decline to do so, the State forester would be asked to handle all dealings with the counties, review and submit their data to the Forest Service with other recommendations and suggestions. The counties would be asked to review the entire report before it is submitted to the Congress, and they, and the State, would have 60 days to prepare comments which would be included as part of the final report. One-third of the total appropriated for the survey will be available to the State forester for his expenses and that of the counties.

The report on the survey would outline the various measures to be taken, the facilities to be provided, the organization and manpower required, the cooperation to be effected, and the legislation necessary. The report would show, separately, data for each county and for the State, the degree and extent of the Federal cooperation involved, and estimated costs, and indicate the legislation locally needed to make cooperation feasible.

The report should include all manner of protection requirements. These should include, but not be limited to, the following: Detection aids (lookouts, patrols, radar, TV, etc.), transportation aids (roads, trails, airstrips, or other landing facilities, aircraft, etc.), water facilities (reservoirs, tanks, pipelines, pumping stations, etc.), weather modifiers (generators, chemicals, physical aids, etc.), structures (buildings, stations, dams, canals, underground storage, etc.), automotive equipment (aircraft, pumpers, tankers, trucks, other types of motor vehicles, etc.), supplies and other equipment (hand and machine tools and devices, supplies and material to support the fire-control organizations, chemicals, medicines, blankets, clothing, and shoes, etc.), communication aids (telephones, radio, TV, radar, power stations, etc.), personnel, rehabilitation aids (seeds, dams, terraces, basin listing, chemicals, earth-moving machinery, etc.).

The report should also present whatever changes may be necessary in terms of organization requirements to maintain a yearlong protection system, as well as the cooperation needed to effect it.

The report should present the data in appropriate form with maps, tables, charts, and diagrams as well as other illustrative material, for the area as a whole, for each national forest, for other Federal lands, and for each county. The report would be presented directly to the Congress. The report would be revised at 5-year intervals.

The cost of the survey is estimated at $500,000 initially. The periodic reports at $50,000. The initial report should be completed within 30 months after the appropriation has been made available.

5. FIRE-HAZARD REDUCTION

Fire-hazard reduction should be an inseparable part of fire control in southern California. So far, practically nothing has been done anywhere. In this chaparral region, research is essential to determine what can be done, and how best to do it.

Hazard reduction can take several forms: One is fireproofing the combustible material with chemicals to make fuels less flammable. Another is the breaking up of extensive areas of hazardous material into smaller units. Another would be through reducing the amount of fuel on the ground and that annually produced. A combination of such measures may be feasible.

Research is needed to determine the method and its effectiveness, especially under the various local circumstances of climate, terrain, and cover. The value of the adopted measures would appear in reduced fire danger or in the rate at which fires burn. Findings might determine reappraisal of the entire organizational setup for fire control.

Legislation is not needed, as authority for such work is carried in the Forest Research Act of 1928. Appropriations only are required; these should be of about the magnitude of $300,000 annually for a period of about 10 years.

Cooperation of all fire-control agencies and political subdivisions in southern California dealing with the problem should be invited. Indeed, these units might well show their interest by financing a third of the cost.

6. FIRE RESEARCH

Other phases of fire research should be carried on simultaneously. This research should cover all phases of fire control rather than being limited to one or another phase at any one time. Not only is research needed on all types of equipment, but it is needed on organization and practices as well. Factors entering into combustion should be investigated, as well as factors responsible for rate of spread of fire and for fire behavior. Much effort is needed, both in the field and in the laboratory and wind tunnels.

Further research is also needed on the kinds and varieties of plants and structural devices useful in reclaiming denuded lands.

Authority for all such work is carried in the Forest Research Act of 1928. Local public and private agencies should cooperate in the studies and share in the cost.

7. COOPERATION

Positive cooperation in fire control among all involved is essential. It must extend through all levels of government, and at all stages. Only by unselfish cooperation can efforts be unified, lines of action be clarified, and plans translated into action. While cooperation does exist, it is not now complete, formal, or fully organized. In fire control, it must include organization, operation, and responsibility. It must include all phases of detection, prevention, reporting, and suppression. It must function in every area in every situation.

A Southern California Watershed Protection Committee is suggested. This committee should be formalized by legislation.

The function of the committee would be to determine upon policies which should govern fire-control objectives. It would suggest the degree of responsibility to be assigned the different fire-control agencies for different actions; the cooperative principles which would apply in the different areas or situations; cooperative fiscal policies not contained in law; budget requirements; legislative needs; research projects or programs. It would also consider action taken on large fires.

The committee should consist of the regional forester of California and 1 forest supervisor from southern California with wide experience in fire control locally, the State forester, 3 county representatives to be chosen by the regional forester and the State forester and mutually satisfactory, 3 representatives representing the public. The latter shall be appointed by the Secretary of Agriculture. One shall be from agricultural interests of the region, one shall represent the water interests, and the third shall represent the local public. The public representatives may serve not more than 2 terms of 3 years each, which shall be staggered.

The annual cost of the committee is estimated at $30,000 annually including the cost of printing.

Committee meetings should be held not less often than one each quarter.

8. ADEQUATE FUNDS

Adequate fire control requires adequate funds. What is adequate at one time can become inadequate as inflation reduces the purchasing power of the dollar. Also adequacy may change with conditions of weather, location, human occupancy and developments.

Money is the basis and a key element in the whole fire-control picture. To the extent money is available, procedures and action are directly affected. Though organizational failures may develop in the best of organizations, though equipment may fail at unexpected and embarrassing times, and though men may make serious mistakes in judgment and action, money remains as a critical factor.

In the Federal Government, restrictions placed upon agency heads by policymakers and the budget approving groups before estimates are presented ot the Congress have the effect of preventing the public from knowing just what the real situation may be. Further, administrative policies prevent Congress from determining just what the situation may be when estimates are presented to congressional committees. The result is that appropriations often fail to meet basic needs.

In a war, expense is a minor consideration. Fire control partakes of comparable elements. The expenditures in fighting fire can be reduced by adequate organization and facilities to prevent serious outbreak. Heavy losses of watershed values, recreation, wildlife, and destroyed resources reflect inadequacy in

organization and facilities to prevent or catch fires while they are small. In the end, it is the public which pays one way or another, whether in money for prevention and control, or in damages.

COMMENTS SUBMITTED TO THE HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS BY THE DESOMOUNT CLUB, REPRESENTED BY DIRECTOR OF CONSERVATION ROLAND CASE ROSS

I. Distinctness of term chaparral

Brushlands of many lands, as maquis, garigue, encinar.

Brushlands of North American desert scrub, second growth, thickets, Krummholz.

Brushlands of California, timberline Krummholz to below sea-level saline halophytes, northern California soft chaparral to southern California hard chaparral (this is true chaparral), forest second growth, Great Valley foothill evergreen woodland with isolated patches of scrub thickets, riparian thickets (river and flood plains), rain shadow or east-side desert brushland.

II. True chaparral is southern, is coastal, is overpopulated

Hardwood impenetrable thicket brushland of mixed species thins northward, yields to weedy, herbaceous soft chaparral midcoast north, stops upmountain at the forest line, fails to flow over to the east or continental side (desert side) of our southern and Sierra back ranges. It is southern California plant formation in strict definition.

It does not occur without the prevailing maritime or sea breeze, characteristic and definitive of the Mediterranean climate; it is therefore a coastal as well as southern feature.

The Mediterranean climate has drawn the world's greatest modern migration within a national unit. The fire hazard index has upped with this influx of wet-climate, ignorant (climatically), hazardous, outdoor enthusiasts.

III. Southern California's unique fire hazard, unparalleled influx of wet-climate people, needs unique rating and legislation, and fire control

Chaparral is a must—scientifically irreplaceable; grows naturally on low rainfall; survives hot, arid summertime; holds soil, water; human culture strictly dependent.

Save chaparral or lose culture, cities, population.

IV. A new emergency index of watershed control is needed

Fire hazard, flash point, litter zone fuel content all are high in southern California chaparral in dry/hot season.

Total dry fuel extraordinarily high—no parallel among other woodlands, forests, brushlands (dry fuel reference).

Present fire-suppression agencies well coordinated.

Funds, equipment, manpower consonant with emergency nature of southern California watershed cover needed.

Composite index of flash fuel, fuel density, watershed service, population use (hazard) is needed.

Comparative study of such index will show southern California unique.

The CHAIRMAN. As to any statements that may be submitted later, the Chair would request that the staff permit the Chair to examine the statements before they are put in the record. All statements of reasonable length will be permitted in the record. Sometimes people want to submit a portion of the Encyclopedia Britannica, so we have to take a look at them. We will do that.

Any other parties present desiring to submit a statement may do so.

If you care to submit it after these hearings, you submit it to me at the office of the chairman of the House Interior and Insular Affairs Committee, New House Office Building in Washington, D. C.

Do you have a statement to submit?

Mr. HEWITT. I have a prepared statement made very hastily since yesterday, and there are some typographical errors in some parts of it.

The CHAIRMAN. How long is it going to take you?

Mr. HEWITT. Five minutes.

The CHAIRMAN. You may proceed. Give your full name and address for the record.

STATEMENT OF CARL N. HEWITT, SUMMIT, CALIF.

Mr. HEWITT. My name is Carl N. Hewitt.

The CHAIRMAN. Your address?

Mr. HEWITT. Summit, Calif.

I live in the Crestline, Lake Arrowhead area. I have resided there some 42 years as a rancher. During this time I have been on most all of the major fires and many of the minor fires. For some 30 years of that residence I was a member of some county board or commission charged with budgetmaking and policymaking and directly responsible for fire prevention and suppression activities.

Your keen interest in and wide knowledge indicating careful study of our difficult, complicated, and often baffling fire prevention and suppression problems is heartwarming to me, a private landholder, with 42 years residence within the San Bernardino National Forest. I feel encouraged as never before that, with your able assistance through the Congress, we will be able to solve or greatly reduce the serious and very real damage that exists in our area to hundreds and possibly thousands of human lives, predominantly grandparents who have retired here, our wives and children on vacation here, and hundreds of thousands of tourists and vacationers from every State in the Union and many foreign countries.

Ours is truly a national and international problem worthy of the continued careful study and deep interest you have manifested here. This danger to human life and highly improved property on a large scale is not occasional, but exists from 3 to 6 months of every year, more often the latter, during which time we have high velocity, low humidity, rapidly shifting winds, which made the recent Malibu fire so dangerous and extensive.

During these high winds, which are not uncommon, we can neither protect nor evacuate the permanent residents and vacation occupants of some 12,000 cabins and palatial homes in the Crestline Lake Arrowhead areas alone that on many weekends are filled to overflowing with tens of thousands of happy vacationers of all ages, most of whom are ignorant and unsuspecting of this very real danger, for emphasizing which I have been and will again be severely criticized.

My qualifications for making this seemingly bold and apprehensive statement with some background of knowledge and experience is 42 years of continuous residence in the area. For some 30 years of this time I was a member of various budget and policymaking boards or commissions directly responsible for fire-prevention and suppression activities, as well as a representative from this area or the conservation committee of the State chamber of commerce for several years.

Returning to the extensive and serious Malibu fire, above mentioned, I would like to stress that, instead of brush 10 to 15 feet high at most, we have here a dense second growth of various conifers, mostly ponderosa, 60 to 100 feet high. This dense stand is again undergrown in many places with a third growth of chaparral and incense cedar very dense and 10 to 20 feet high.

In such locations a fire out of control in high winds would most certainly crown and could be murderous beyond description in this virtual city covering miles of this dense forest and occupied almost every weekend by tens of thousands of people during weeks and months of high fire danger.

Am I crying "Wolf, wolf" with no plan or program for adequately combating or minimizing this colossal danger to $100 million worth of highly improved property and hundreds or even thousands of human lives in this most intensively used timberland recreational area of its kind in the Nation? By no means.

What we need and must have as soon as humanly possible to avoid someday being justly charged with criminal negligence is immediate readmitting and revamping of the zone 5 flood-control plan, carefully engineered 15 years ago, of pipelines, lakes, and volume storage on high points with access roads and adequate escape routes with wide firebreaks and large safety islands, extensive hazard reduction, and a carefully studied evacuation plan. This is not merely a brainstorm of any one individual, but was put in writing by no less an authority than our highly respected deputy State forester, James Mace, and his able assistant, Butch Skinner, as long ago as 1950, after several field trips, followed by a joint conference of all Federal, State, and local fire and forestry officials from San Diego to San Francisco. At this joint conference these plans, written up by Mr. Mace and Mr. Skinner, were carefully discussed and concurred in by all the "top brass" above mentioned. The closing statement of this evacuation plan in the event of threatened fire danger was:

That it be completed and written up and a copy in the hands of every establishment, commercial and residential, not later than March 1951.

The fire tax rate in the Crest Forest district has been around $1 per $100 of valuation for many years. The district is currently spending about $10 per acre annually for all private land within its boundaries. Our greatest danger is from adjoining Federal land where the United States Forest Service is spending less than 15 percent of that amount. Clearly this inequity should be remedied by giving our United States Forest Service men more funds, so they can do their share of protection work. They are a group of dedicated and capable men. Given adequate funds and a little constructive criticism, such as Chairman Engle voiced in San Bernardino last week, in which I concur, they will do a good job. Let us not forget that criticism and difference of opinion are just as valuable and a necessary part of our American way of life as commendation and cooperation.

In closing, I wish to mention one source of fire origin that is almost wholly ignored by our Federal and some State forestry and public-utilities officials. I refer to the high voltage transmission lines of our multimillion dollar highly prosperous public utility electric corporation. I have facts and figures proving that actual fires started during the last 4 years in this critical area are many times more dangerous than all other sources of fire origin combined.

That is a rather broad statement, but that is an actual fact: in proportion to the number of these power lines and the number of cabins and other sources of fire danger, they are far more frequent in starting fires than all other causes combined.

Thank you.

The CHAIRMAN. If you have the facts and figures for that last statement, I would like to see them.

Mr. HEWITT. I shall be very glad to submit that.

The CHAIRMAN. If you get them, send them in to us, because we would like to see that substantiated, if it is true.

(Mr. Hewitt's letter and supplementary report follow:)

OCTOBER 23, 1957.

Congressman ENGLE,
Chairman, House Interior and Insular Affairs Committee,
Washington, D. C.

DEAR CONGRESSMAN ENGLE: Enclosed please find copies of the additional information which you requested in support of the closing paragraph on power-line fires in my prepared statement made on October 9, 1957, at your hearing in Los Angeles.

Also, please find copies of a letter to the San Bernardino County Board of Supervisors in June 1952, with excerpts of tests made by the city of San Francisco in 1952 and reported to our Crest Forest fire department by the civilian defense. This is "the something out of the ordinary" that, as I remember, both you and Representative Sisk asked for near the close of the hearing.

I can give you much more additional information on this including very satisfactory tests by our local fire department.

Referring to my enclosed copy of letter to the San Bernardino County Board of Supervisors, several miles of this 6-inch pipe was purchased by the State and is now stockpiled here in southern California and could be adapted and used for fire suppression on major fires at very little additional expense.

Very truly yours,

CARL N. HEWITT.

ADDITIONAL INFORMATION REQUESTED

HOUSE INTERIOR AND INSULAR AFFAIRS COMMITTEE,
Washington, D. C.
(Attention Chairman Engle.)

DEAR CHAIRMAN ENGLE: On the basis of records carefully kept by the Crest Forest fire department for 1953–56, there was an average of 18.5 fires a year from all causes, excepting incendiary, automobile, and smokers.

Assuming that cabins and cabin occupancy was the source of origin for all of these fires which is not the case, the picture is as follows: There are well over 5,000 cabins in the Crest Forest district alone; 5,000 divided by 18.5 equals 1 fire a year for each 270 cabins.

The California Electric Corp. has two high-voltage steel-tower electric lines crossing the west end of the Crest Forest district, 1 for a distance of 4½ miles, the other paralleling within 1 mile to the west, some of it outside of the Crest Forest district.

From December 11, 1953, to November 6, 1956, these 2 lines started 6 fires. That is 1 fire a year for each line in 2 years, 10 months, and 25 days.

On November 6, 1956, 6 fires were started simultaneously over a distance of 600 feet by a line failure some 250 feet from a tower out in a span. Laboratory tests of this cable showed it was far below the manufacturer's guaranteed minimum for cable of this size today.

This is the second time in about 20 years that a cable failure has started four fires at once over a distance of several hundred feet, a very dangerous situation.

All of the above 6 fires burned a total of 3,912 acres according to the United States Forest Service at a total suppression cost of right at $100,000.

From 1929 to date, in 27 years, only 1 fire that could be attributed to cabin use resulted in a major fire. This was on Thanksgiving Day, 1938, almost 20 years ago.

During the said 4-year period 1953–56, there were only 8 smoker fires reported for several million smokers in the area and only 7 automobile fires for some 2 million cars passing through the district.

This looks like my statement that in proportion to numbers the power lines were many times more dangerous than all other sources of origin combined for the past 4 years might even qualify as a classic understatement.

Very truly yours,

CARL N. HEWITT.

CEDAR SPRINGS,
Summit, Calif., June 25, 1952.

SAN BERNARDINO COUNTY BOARD OF SUPERVISORS,
San Bernardino, Calif.

GENTLEMEN: In the fall of 1947 a date was arranged by a member of the fire commission with a local distributor for a demonstration of portable aluminum irrigation pipe for fire-fighting purposes. It was thought by some that both by the use of sprinklers and the greatly increased volume of water which the pipe would carry above that of canvas hose that it would be a valuable aid in the control of major fires. Four-inch portable pipe will carry over 4 times the volume of water that the largest hose commonly used (2½ inches) will carry. Six-inch portable pipe will carry up to 15 times the volume of 2½-inch hose at the same pressure and costs much less than first-grade hose. Looks like it might be real economy to replace 2½-inch hose with 6-inch pipe for conveying a large volume of water to a major fire. Four-inch pipe with all fittings sells for less than $1 a foot and will greatly outlast the host which in the best grade with underwriter's stamp sells from $1.50 up, the cheapest over $1.

This first scheduled demonstration was passed up because of a snow storm. Because some members then on the fire commission considered it a wild idea the matter was not further pushed by anyone on the commission; however, due to repeated requests and inquiries from various individuals throughout the years, it was requested that another demonstration and test be arranged. The commission accordingly requested the chairman to make arrangements for such a demonstration. After consulting with several distributors and some manufacturers a demonstration was arranged for with Mr. Cecil McGehee, distributor for rain-control equipment put out by Hardy Manufacturing Co. and manufactured by the Glendale Foundry. Mr. McGehee offered to bring 1,000 feet of pipe to the district without cost and assist in the tryout, which he did on June 4, 1952. This demonstration was announced 2 weeks ahead to Federal, State, and other county fire-fighting agencies, all of whom had representatives present.

After the announcement, and 1 week before the test, a letter came to the fire department from the office of civilian defense at Sacramento reporting a similar test for the San Francisco Fire Department. Following are excerpts from this report:

"Enclosed is a report submitted by Battalion Chief William Gilmore, director of training and instruction, to Edward P. Walsh, chief engineer of San Francisco City Fire Department, indicating the results of two separate field tests made March 22 and April 5, 1952, on quick-coupling aluminum pipe. The purpose of the tests was to determine if the pipe would be suitable for use as emergency water mains for relaying water for fire-fighting purposes.

"Included in this mailing is literature describing the W. R. Ames Co. pipe that was used in the tests. Although the W. R. Ames Co. furnished the pipe and assisted the fire officials in conducting these tests, there are many other manufacturers who produce this type of pipe.

"We have advised that various size couplings can be welded to stock fittings meeting the fire department's requirement. You will note in the report that the San Francisco Fire Department used 3-inch couplings. The results of these tests have clearly indicated that with minor modifications this pipe, or similar type pipe, would be suitable for use as surface water mains during times of disaster. The State fire advisory committee witnessed the test of April 5 and recommended that consideration be given to the purchase of this type of pipe for stockpiling throughout the State.

"Pipe was purchased and is available for tests and/or use.

"The pipe and hose were laid by the regular crews of engine companies 11 and 29. The layout was accomplished in a very few minutes by men having no prior experience with irrigation pipe. Working teams of two, they laid the pipe about as fast as a man would walk at normal speed. (This last paragraph is taken from that portion of report headed 'First Test,' the next paragraph is from 'Second Test.')

"The pipe and hose were laid by the regular crews of engine companies 11 and 29; some of the members had participated in the previous test. About half of the pipe was laid from the pipe truck; the remainder was carried over the uneven terrain without difficulty. The entire layout was accomplished in a very few minutes.

"During the tests, a few failures occurred at the joints. These were later determined to have been caused by breakage of the coupling springs. No such failures occurred during the first tests.

"The pipe accommodated itself to the uneven terrain without extensive manipulation or special bracing. Except for the joint failures caused by coupling spring breakage, the pipe performed satisfactorily in every respect.

"SUMMARY

"Commercial irrigation pipe of the type tested, with minor modifications, is readily adaptable to use as emergency water main for fire-fighting purposes under conditions of natural disaster or enemy attack. Such pipe can be laid over level ground or over rough terrain and rubble such as would be encountered in many areas under such conditions.

"The pipe can be laid at a fairly rapid rate by small crews of men with little or no special training.

"The flow characteristics of the irrigation pipe are evidently somewhat better than water main of the same size.

"The flexibility of the pipe, its relatively large carrying capacity, its ease of handling, and its minimum of deterioration while in storage indicate that serious consideration concerning its use under disaster or enemy attack conditions might well be given by fire protection and civil-defense authorities."

Very truly yours,

CARL N. HEWITT.

CEDAR SPRINGS,
Summit, Calif., October 23, 1957.

Congressman ENGLE,
Chairman, House Interior and Insular Affairs Committee,
Washington, D. C.

DEAR CONGRESSMAN ENGLE: The photostatic copy of newspaper report attached hereto is partially self-explanatory.

The August 11, 1952, test was the third in a series of five tests during which time the manufacturer, the Glendale Foundry Co., entirely recast their couplings so that they stood 375 pounds pressure on the last test at which the brand new 2½-inch first-quality hose burst three times with no pipe or coupling failures.

The February 11, 1954, report of a regular Crest Forest Fire Commission meeting was scheduled for the first Tuesday of the month. The Wednesday before this President Eisenhower announced the San Bernardino National Forest as a disaster area due to recent severe floods. I considered this an invitation to ask for help from Washington to prevent such future disasters.

It immediately occurred to me that the best way to get a fast expression from a large number of people was through these organized youth camps. Accordingly I got on the telephone Friday morning and began calling these camp representatives. I called the last one about Tuesday noon. Every single man I called came and some of them brought others so that almost the entire number of camps in the forest were represented.

Most of them made excellent speeches appealing for help to protect their boys and girls on vacation in our forest and all expressed real concern because of the fire danger for the safety of the hundreds of thousands of boys and girls entrusted to their care. I have all of these speeches on a tape recording and would like to present it to your committee some time.

With this phenomenal response I am almost ashamed to tell you that I could not get the cooperation of the United States Forest Service supervision and local ranger to present it to Washington. They even called some of these men I had called and tried to persuade them not to come to the meeting. I suspected also that they had some influence on the board of supervisors for they also took no supporting action. Later when the opportunity was past, the board of supervisors tried other measures but without success.

I have transcripts of the speeches made by these men taken from my tape recording and would be glad to send you copies if you can use them.

Very truly yours,

CARL N. HEWITT.

TEST OF PORTABLE FIRE-FIGHTING PIPE STAGED SUNDAY

Tests of portable aluminum pipe for use in fighting mountain forest fires took place Sunday in the San Bernardino Mountains under the direction of Crest Forest Fire Commission.

The distinguishing factor of the pipe, demonstrated publicly near Cedarpines by the Crest Forest Fire Department, is that it can send a direct stream of water or be converted to a sprinkler unit, dampening an area within a 75-foot radius from outlets 20 feet apart.

The importance of the sprinklers in preparing the ground for a "back firing" operation was pointed out by Dr. Carl N. Hewitt, chairman of the commission which originated the test. With the pipe, men would not be required to soak the forest with hoses, but could be redeployed to fight elsewhere or start a back fire which would force the blaze against the sprinkler-dampened area, said Hewitt.

CAPABILITIES TOLD

Six to ten men can handle 1,000 feet of 4-inch pipe which plays 400 gallons of water per minute through a 1-inch nozzle. A 6-inch pipe which is available for use plays 1,200 gallons per minute at the point of fire.

"We are seeking equipment," Hewitt said, "that will keep a continuous high volume of water on the fire. The rain control department of the Glendale Foundry Co., Los Angeles, which provided the pipe for the demonstration, indicated that they could build pipe able to withstand a 1,000-foot change of elevation."

The pipe which has been successful in commercial agriculture was first tested for fire fighting by the Civilian Defense Corps in April 1952 at San Francisco. At that time they recommended its use in mountain fire control. A 360-degree main line swivel valve in the pipe makes it particularly adaptable to mountain use.

The Crest Forest Fire Commission is negotiating, with the cooperation of the district flood-control committee, for the purchase of 2,000 feet of the pipe at an estimated cost of $2,500.

Members of the commission are Hewitt, chairman, Joe Bertucci, Fred Lang, Arch Johnson, and Ernest Pritchard.

UNITED STATES GRANT OF $5 MILLION URGED FOR NATIONAL FOREST

Representatives of more than 60 junior and church group camps in the San Bernardino National Forest will urge the Federal Government to provide $5 million for presuppression improvements in the popular recreation area.

Such improvements—mostly for fire protection—would include additional and improved roads, firebreaks, safety islands, water development, and hazard reduction.

Also attending the Tuesday night meeting were officials of both the United States Forest Service and the California State Division of Forestry.

HASTILY CALLED

The meeting was hastily called and sponsored by the commissioners of the Crest Forest Fire District—one of the oldest and largest mountain fire districts in California.

The meeting at Crestline was originally called to ask mountain property owners if they would approve a proposed 60-cent addition to the tax rate for a period of 1 year for the purpose of raising $30,000 to be spent on improving Federal lands in the forest area.

Speakers pointed out that the Angeles National Forest is asking for $4 million from the Federal Government, and that the use of the San Bernardino National Forest is almost double that of Angeles—including the use by Los Angeles organizations and individuals.

REPRESENT CAMPS

Speakers included Ernest L. Pritchard, chairman of the Crest Forest Fire District; H. A. Hansen, representing the Idyllwild Youth Camp and the Southeastern California Conference of Seventh-day Adventists; Elder B. F. Williams, secretary-treasurer of the Southern California Conference Association of Seventh-day Adventists, and the Cedar Falls Youth Camp; Thomas J. Harrison, supervisor of park services for the city of Los Angeles; Paul M. White, representative of the crippled children's camp at Pravika (at the head of Devils Canyon).

The speakers represented some 500,000 mountain camp users in the San Bernardino National Forest.

It was urged that the request for Federal funds be forwarded to Washington in time for the March 1 budget hearings.

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OTHER SPEAKERS

All were agreed that the $2.5 million budget request for the San Bernardino National Forest—as requested by Supervisor Sim E. Jarvi—is not sufficient for improvements needed in the area.

Other speakers at the meeting included Ira Fox, Jr., director of the Baptist camp at Thousand Pines; E. Arthur Larsen, Jr., director of the department of youth and Christian education at Arrow Bear Park; and Graham Tinning, representing Forest Home, Inc., and seven other camps in the forest.

Representing the State division of forestry were James K. Mace, deputy State forester, and his assistant, Eugene H. Bertsch, and W. W. Skinner, State forester from San Bernardino.

It was pointed out during discussions that the San Bernardino National Forest tops the combined use of the other three national forests in southern California and doubles that of the Angeles National Forest.

Use funds paid into the San Bernardino forest last year amounted to $97,454. These funds—representing money paid for special-use permits—are deposited in the Federal Treasury.

The CHAIRMAN. This brings to a close the hearings.

Mr. NIELSON. Mr. Chairman, my name is George W. Nielson. I wrote you last week in connection with withdrawals on certain policies of the Department. I would like to write this committee on the same subject in connection with the Small Tracts Act. May I do so?

The CHAIRMAN. We will be glad to have your statement, and it will be made a part of the record in connection with the hearings on that subject matter.

Mr. NIELSON. I am sorry I did not know about this sooner.

The CHAIRMAN. This is Forest Fire Day.

Mr. NIELSON. I did not know about the other on Monday.

The CHAIRMAN. This committee has been on the road for approximately 2 weeks all together counting the time to get the committee together, all in southern California, dealing with these problems relating to the public lands of the United States of one kind or another.

As Mr. Roberts pointed out, I think, one of the great difficulties is that congressional committees hold hearings, and after all the clamor and talk has subsided then nobody ever does anything. And very often, I will say, the results of the hearings are limited to the benefits of airing a problem rather than in specific action.

In this case, we intend to try to get something done, and our staff people will prepare a summary of the recommendations which have been made to this subcommittee, and then the committee itself will prepare a report in which we will suggest certain specific actions. Some of those are executive in nature, that is, they involve actions which ought to be taken in the executive branch of the Government. In some instances we may have to enact laws to make people do things that they ought to do but do not do. If that develops to be the case here, we will try to do that also. But we want to proceed in a constructive fashion with reference to all of these problems.

I have a feeling with reference to some of these so-called forest lands that for all practical purposes they have lost their character as forest lands and have become something else, like the Small Tracts Act, which we found to be inappropriate to manage some of the problems related to the settlement of people on public lands adjacent to urban areas.

We also find that there is a very strong possibility in some areas, through people moving into them in vast numbers, that they tend to lose their character as national forests.

To what extent that has occurred, I am not prepared to say at this time, but, in any case, there are certain very definite and active things that should be done in this area, and I think when we take action to put this forest on a year around basis we are not going to get it done unless we earmark the funds, because there is politics in the Forest Service, believe it or not, just like there is in any other outfit, and they will start scratching for that money.

Just a plain increase in appropriations is not sufficient. We are going to have to characterize a particular area as one deserving of special attention and treatment, and I think certainly this one does. It does not fit into the normal category of Forest Service operations, certainly not the kind I have in the Sierra Nevada Mountains up north. Specific designation of certain types of areas where the Forest Service operation ought to be 12 months in character—I suspect my friend from Arizona has something like that, too—ought to be considered in that category.

In any event, I would say these hearings have been constructive and have been informative and helpful to this committee, and we appreciate the attendance of all of you who have appeared and made that possible.

Do you have anything further to say, Mr. Sisk?

Mr. SISK. No, Mr. Chairman, other than to commend all of the witnesses on this part of our hearing, because I think the testimony has been exceptionally good in every case. The intense interest and concern these people have shown is to be commended.

Mr. Chairman, I am very happy to have been here, and it was most educational for me. Thank you.

The CHAIRMAN. Mr. Rhodes.

Mr. RHODES. I have very little to say, except I certainly appreciate the fine treatment I have received here in southern California, not only in Los Angeles but in other cities, and the fine treatment I have also received from my good chairman, but that is not new because I am always treated well by him.

Also, I might enlarge on the statement the chairman has made as to the character of certain national forests. I will do it very briefly.

It seems to me this particular forest here has gotten out of the category of growing trees. This is a forest which can be a menace but can be a great asset, too, for the fish and wildlife, recreational facilities, but mainly for the production of water.

I just suggest this, and it will go no further as far as I am concerned: Maybe the county of Los Angeles, since this is a local forest and gives rise to an awful lot of local problems, should some day consider requesting the Federal Government that the Angeles National Forest be turned over to it and operated by the county of Los Angeles for the benefit of all of the people in this area. That is just a suggestion, but sometimes, you know, when the problem is local the local people can do a lot better job of it than somebody back in Washington.

Thank you.

The CHAIRMAN. I would have to add to that so there is no confusion about my thinking. I had in mind the residential character of some of these forest areas. In flying over them, we noticed that people have moved into the forest areas to the point where they are not

forests any more, they are practically subdivisions, and it is that transition of an area I have in mind.

I think that water conservation is an appropriate and important function of a nationl forest, and in some areas the No. 1 function, as it has been not only here in the South, as it is in the forest next to Denver, and as it is, for instance, in the Hawaiian Islands. But the fact that it is a watershed-protective area does not, in my mind, affect the fundamental forest character.

When you have people moving out into an area to the point where you practically have a solid community, as we noticed on the ridges coming over, then I wonder whether or not we are getting out of the area where the functions of the national forest, as such, are appropriate.

Mr. RHODES. Now you are forcing me to say something. I certainly do not want anybody to think that I do not think national forests have the function of producing water, because a lot of mine do, and I want to keep them that way.

The only thing I indicated was this appeared to be more and more a local forest and tied inextricably with local problems.

The CHAIRMAN. I hope we have sufficiently clarified the situation.

Off the record.

(Discussion off the record.)

The CHAIRMAN. The meeting stands adjourned.

(Whereupon, at 3:10 p. m., the subcommittee closed their hearings on this subject.)

(Pursuant to permission granted on page 247, statements received from Harry T. Hall, president, southern California section of the American Camping Association, Horace P. Hinckley, general manager, Bear Valley Mutual Water Co., Harry C. James, President, The Trailfinders, and John T. Hales, Advertising Manager, Transland Co., Los Angeles, are also included in the record.)

OCTOBER 9, 1957.

To: Special Subcommittee of the House Committee on Interior and Insular Affairs, Congressman Clair Engle, chairman.

Subject: Hearing on forest and brush fires in southern California, October 8–9, 1957, United States Courthouse Building, Los Angeles.

From: Harry T. Hall, president, southern California section of the American Camping Association.

Representing some 170 organized camps with a current summer attendance of better than 100,000 boys and girls, the southern California section of the American Camping Association is very much concerned with the forest and brush fire problem. The great majority of our camps are located in State and National forest areas. The safety of these youngsters is of major concern to us all.

The height of our summer camping season is, sadly enough, the time when the forest is the driest and the fire hazard the greatest.

So far we have been extremely fortunate. Our greatest losses have been in property and in the loss of wilderness area, but as we grow (and we are growing—the increase in 1956 in attendance was 17.1 percent over 1955, and this summer it will be even greater), the problem of control and safety will be an ever growing one.

Also, while safety is a major concern, we too have a vital interest in the forest itself, as this is the camp leaders' laboratory and the youngsters' chance for adventure.

We want this committee to know that the membership of the southern California camping association will vigorously support any legislation that will allow for more adequate fire protection for our forests and brush country areas.

STATEMENT REGARDING FIRE PREVENTION IN SOUTHERN CALIFORNIA NATIONAL FORESTS, BY BEAR VALLEY MUTUAL WATER CO., REDLANDS, CALIF.

For the past 74 years this company has utilized the flow of the Santa Ana River as it enters the valley area east of San Bernardino. This watershed of some 200 square miles is entirely within the San Bernardino National Forest and comprises the highest mountains in southern California. The water runoff from the Santa Ana River is sufficient to support the growing of approximately 10,000 acres of citrus orchards.

Our interest in preserving the forest cover is vital to our survival and we have watched and cooperated with the Forest Service in suppressing fires ever since the San Bernardino Mountains were set aside as a national forest in 1895.

The Bear Valley Mutual Water Co. has urged and supported the Forest Service policy of setting aside high fire-hazard slopes as closed areas. Experience has proven that exclusion of hunters and the public in general is the most effective way of preventing forest fires. Although much of our own company land is in the closed areas we urge support of and extension of this closure policy.

Secondly, we are heartily in accord with the program of fire preplanning which has recently been put into effect on a portion of the forest. From actual experience in the field during fires we have seen the helplessness of men if they are not acquainted with the terrain and the existing facilities. The system of heliports, signed truck trails, water points, etc., all means more efficient operation when the fire is actually burning. In this connection may I point out that the local flood-control district this year for the first time in its history has budgeted $2,500 to be turned over to the United States Forest Service for preplanning work in the high fire-hazard areas of the San Bernardino National Forest. Also the local soil conservation district is doing all in its power such as renting equipment at cost to the Forest Service to accelerate the installation of roads and firebreaks in high fire-hazard country.

The most important use of Forest Service lands in the San Bernardino National Forest is the water which they produce and the economy which this water supports in the valley area below the mountains. To protect this economy we urge:

1. Appropriations be continued at their present or increased level so that the Forest Service can use the latest techniques and equipment in putting out forest fires once they are underway.

2. More effective work can be accomplished if the forest has been mapped and signed or a fire preplan worked out and to that end we urge that moneys be made available to cover the entire watershed area with the necessary preplanning work.

3. It is our position that as much of the national forest as practicable be set aside in closed areas thus reducing the expense of administration as well as curtailing the incidence of forest fires.

Respectfully submitted.

BEAR VALLEY MUTUAL WATER CO.,
HORACE P. HINCKLEY, *General Manager.*

THE TRAILFINDERS, LOLOMI LODGE,
Banning, Calif., October 7, 1957.

HON. CLAIR ENGLE,
Chairman, House Interim Committee on Interior and Insular Affairs.

DEAR SIR: The Trailfinders asks that the following statements be made part of the record of your hearings in Los Angeles:

Since the establishment of our organization in 1913–14 we have carried out an extensive camp program on weekends and during the longer school vacation periods. Since 1950 our headquarters has been located in the San Jacinto Mountains of the San Bernardino National Forest. During all these years we have been in more or less constant and intimate touch with innumerable men connected with the United States Forest Service, and time after time we have engaged in fighting brush and forest fires in the national forests of southern California. As recently as 2 years ago a brush and timber fire occurred in the Lake Fulmor picnic area which adjoins our property in the San Jacintos.

We have come to have sincere appreciation for the efficiency and promptness with which recent fires of this kind have been taken care of by the Forest Service. The staff work that has been done in the offices of the various forest supervisors

in our opinion has developed mechanized on-the-ground fire fighting to just about the most efficient possible point.

However, damage done by extensive chaparral fires within the past 2 years has been almost catastrophic. The cost of bringing these fires under eventual control has been enormous; and serious, sometimes fatal, accidents have occurred. But to those of us who have been in close and constant touch with Forest Service personnel there has always been unfailing evidence of the careful planning and skilled administration of safety programs calculated to insure as great a measure of safety as possible for the men engaged in the extremely hazardous business of fighting chaparral fires.

In our opinion these serious chaparral fires will continue to be devastating unless two major plans can be given consideration:

First, we feel that there must be more extensive use of airplanes for the spraying or dropping of fire suppressants on or ahead of chaparral fires, and that there must be undertaken at once extensive experiments in the development and spraying of fire retardants in areas of serious fire hazard both before and during the fire season.

Second, we feel that we must secure the cooperation of the Governor of California to the end that he declare a state of emergency when periods of excessive fire danger occur (periods of low humidity and of Santa Ana winds). During this period of excessive fire hazard public use—camping, hunting, etc.—should be stopped or curtailed. At such a time special "alert" bulletins should be sent out over all the usual avenues of communication, radio, television, newspapers, announcements at public meetings, etc. The civil defense setup should be put into operation to set up roadblocks, issue warnings to all persons entering areas of extreme danger, etc.

The Trailfinders and several other organizations and individuals urged this procedure upon the Governor last year. To the best of our knowledge nothing has been done. We note, however, that the Governors of Washington and Oregon take very prompt action in alerting the people of their States whenever a state of emergency exists so far as forest fires are concerned.

It is extremely unfortunate that the opening of the deer season in southern California so often coincides with the period of intense fire hazard. Not only does this bring into highly combustible areas a large number of hunters who may be careless with campfires, cigarettes, and matches, but it also places upon Forest Service personnel an added responsibility in patrol, checking, issuing fire permits, etc., at a time when the full attention of the Service should be given to duties incident to fire prevention and control.

The large and rapid turnover in Forest Service personnel may be a factor militating against the excellent safety program of the Service. Occasionally key positions have to be filled with men newly graduated from forestry school who have had little actual work experience and who have little firsthand knowledge of the territory for which they suddenly find themselves responsible.

The turnover in fire crews often brings untrained green hands on the job just as a major fire occurs. This is a situation unfortunate for all concerned. It is possible that a study of this particular situation might result in the finding of ways and means to rectify it.

Sincerely yours,

HARRY C. JAMES, *President.*

Torrance, Calif., November 18, 1957.

Mr. SIDNEY L. MCFARLAND,
Civil Engineer, Committee on Interior and Insular Affairs,
House of Representatives, Washington, D. C.

DEAR MR. MCFARLAND: Per your suggestion to me at the Committee of Interior and Insular Affairs, House of Representatives, southern California forest fire hearing in Los Angeles, October 8–9, 1957, we are enclosing several Transland reports, T2–13 and T2–16, that may be of value to your committee in evaluating information regarding air tanker usage in southern California fires during the last several years.

Most of us at Transland have lived in southern California for a number of years and have observed the results of major forest fires in our nearby mountains, the details of which have already been amply covered in your Los Angeles hearing by Forest Service, State and county forest officials.

Transland, during the past 6 years, has designed and sold aerial applicating equipment to agricultural aircraft owners for agricultural, insect, and weed control purposes. During this time we have designed, built and placed into production our Ag–2 airplane, developed specifically for aerial applicating duties. The airplane is fully described in our enclosed T2–16 report. With this background we have a natural and considerable interest in the use of air tankers in forest-fire control.

To more fully understand air tanker techniques and requirements we furnished our Ag–2 airplane as an air tanker to the Los Angeles County Fire Department for 3½ days during the Malibu fire in December 1956. This use of our airplane, flight and ground crew and operating expenses was donated by Transland without expense to the county. The complete operation is described in our enclosed T2–13 report.

From the experience gained in the Malibu fire and on-the-spot observation by several of us at Transland of other major southern California fires in 1956 and 1957 we offer the following thoughts for consideration by your committee:

1. Air tanker should be considered as full-time fire equipment available for fire-fighting duty at a moment's notice during the local fire season to prevent minor fires from attaining major fire proportions. These air tankers should be operated by professional fire agencies for maximum effectiveness. At present an initial start has been made by the United States Forest Service in acquiring and modifying several surplus Navy TBM's for full time fire work. Effective results were gained during this 1957 season.

2. These air tankers should be operated by full-time flight personnel who are professionals trained in all phases of fire-fighting techniques on the ground and in the air. Experience gained by the USFS personnel in operating TBM's during 1957 is a definite start in this direction.

3. Most of the aircraft presently used in this work are agricultural aircraft and pilots contracted for by the USFS to be on standby for fire calls. This approach, while practical for the past several fire seasons, may not be the best solution since fire seasons often occur during busy agricultural aerial applicating seasons. The results are that not too many agricultural aircraft owners are interested in bidding for this contract work. Agricultural aircraft will always prove highly useful to fire fighting however, to augment full-time air tankers during major fires.

4. To obtain full value for the investment in full-time aerial equipment and personnel, particularly during the nonfire seasons, use of properly designed and equipped aircraft could be applied to fire prevention and forest conservation work. These additional activities would include fire-patrol duty (while carrying a full load of fire retardant chemicals for immediate action), supply drops, reseeding of damaged watershed areas, forest fertilization and insect control, maintain existing firebreaks by application of herbicides and for aerial control of brush burning. Details of these duties are discussed in our T2–13 report, pages 15 and 16.

5. Research studies should be made to find aircraft capable of these year-around duties and at the same time be economical to operate, easy to maintain, have proper flying characteristics and pilot safety features. Surplus aircraft presently being used do not necessarily meet all these requirements.

To have full-time aerial tankers and crews available for year-around duty would obviously require additional government appropriations. We believe, however, that additional government money allotted to fire research and improvement of operational techniques of aerial fire fighting would prove highly beneficial to our Nation's natural resources and to our local and most vital watersheds.

I might add in closing that we have observed the efforts by the Forest Service, State and local fire agencies and believe that these agencies have made excellent and progressive steps to curtail forest fire damage within the limits of their operating budgets. Forest and fire agency people with whom we have had personal contact have each proved highly cooperative and interested in our Transland activities.

We very much appreciate this opportunity to offer the above thoughts to your committee.

Sincerely,

JOHN T. HALES, *Advertising Manager.*

AERIAL FIRE FIGHTING WITH THE TRANSLAND COMPANY AG–2 AIRPLANE AT THE SANTA MONICA MOUNTAIN FIRE

(December 26–29, 1956)

Compiled by John T. Hales

I. GENERAL

A. This report covers the aerial fire-fighting activities of the Transland Ag–2 agricultural and forestry airplane in the Santa Monica Mountain fire.

This was the most disastrous brush fire in southern California history and came to an end after 4 days in the Hume (Malibu), Zuma, and Lake Sherwood areas in the Santa Monica Mountains. The fire broke out early Wednesday morning December 26, 1956, in the mountains behind Zuma Beach. A second fire erupted late Thursday several miles above the Malibu district. A third, on Friday, swept across the Lake Sherwood hills to join the Zuma fire. The fires were contained late Saturday. The blaze blackened 37,540 acres in Los Angeles and Ventura Counties, with structural damage amounting to $700,000 and watershed damage of $1,250,000 in Los Angeles County only.

B. To help combat the Santa Monica Mountain fire the Transland Co., Torrance, Calif., donated the use of its new Ag–2 agricultural and forestry airplane accompanied by Transland flight and ground personnel. Appreciation is gratefully acknowledged by Transland to the Los Angeles County Fire Department for the opportunity to demonstrate the Ag–2 under actual fire conditions and for the excellent cooperation offered by the department.

Stationed at Santa Monica Municipal Airport, the Ag–2 aircraft and crew working with the fire department's special chemical unit and its crew, made a total of 31 air drops of more than 25 tons of water-borate mix over a 4-day period. The Ag–2 was the only aircraft making aerial chemical drops in the fire area, excluding the helicopter operated by the sheriff's department which was used by fire officials for aerial reconnaissance.

II. THE AG–2 AIRPLANE

The Ag–2 airplane is specifically designed for aerial application of chemicals, seed, etc., over farm and forest lands. Its design combines the engineering philosophy of the experimental Ag–1 airplane constructed in 1950 at Texas A. & M. College's Personal Aircraft Research Center, recommendations of Cornell Medical College's crash injury research, and the agricultural aviation design knowledge of Transland Co. The Ag–2's chief designer is George S. Wing, president of Transland Co.

Following its first flight, October 11, 1956, at Torrance Municipal Airport, the prototype airplane (used on the fire-fighting operation) is presently engaged in its flight-test program to qualify for CAA part III certification in the near future. Production will start in early spring of 1957 and is scheduled to reach a 2 airplane per week delivery by the end of the year, a total of 42 in 1957.

The water-borate payload, averaging about 161 gallons (1,663 pounds approximately, see sec. III, B, chemical used, following) was carried in the 4 wing tanks (62.5 gallon capacity each). A 53-cubic-foot hopper located in the fuselage was not used. The all metal Ag–2's payload under normal operating conditions ranges from 2,000 to 2,200 pounds. The design gross weight of 6,000 pounds is believed to be near optimum size for its Pratt-Whitney R–985 450-horsepower engine.

The Ag–2's pilot during the fire operation was Transland's chief test pilot, Robert "Bat" Masterson, veteran combat pilot and graduate of the Air Force's Experimental Flight Test School at Edwards Air Force Base, Calif.

NOTE.—See addendum at end of report.

III. GROUND OPERATIONS

A. Ground equipment

A Los Angeles County Fire Department chemical unit truck and crew, under direction of Capt. Frank R. Hamp, mixed and pumped the water-borate into the Ag–2 airplane.

The mobile chemical unit consisted principally of a water mixing tank (400-gallon capacity) a 6-cylinder Chrysler engine, a Hale single-stage centrifugal

pump (500-gallon-per-minute capacity), and miscellaneous plumbing and valving equipment.

B. Chemical used

The borate, trade-named "Firebrake", used on the subject fire as well as other California fires in 1956 and in forest-fire research studies is manufactured by Pacific Coast Borax Co., division of United States Borax and Chemical Corp., 630 Shatto Place, Los Angeles 5, Calif.

"Firebrake" is the most effective fire retardant chemical tested to date for use with aerial drops. It is sodium-calcium borate and when properly mixed with water, will stay in suspension indefinitely. Mixed weights are as follows:

	Pounds per gallon
4 pounds Firebrake to 1 gallon water	10.1
5 pounds Firebrake to 1 gallon water	10.33
6 pounds Firebrake to 1 gallon water	10.8

Weight of 5 pounds of Firebrake to 1 gallon of water was determined on the Santa Monica fire operation at 13.35 pounds per gallon to load the airplane to 161 gallons of 2,149 pounds. This was a calculation error based on the above manufacturer's data. Using 10.33 pounds per mixed gallon, the Ag–2 could have carried 47 additional gallons to obtain the same 2,149-pound payload weight.

Research study is being conducted to determine the effect of Firebrake to soil and plant life. Present evidence shows that normal aerial applications of Firebrake does not have any harmful effects on soil or plant life. Present research evidence is still considered by the manufacturer to be too limited to draw any positive conclusions.

All inquiries for more complete data regarding Firebrake or related research studies should be directed to the manfacturer, address noted above.

C. Chemical unit mixing operation

1. The mixing tank was filled with water.
2. The pump sucked water from the tank through the pump to discharge the water at 100 pounds per square inch back into the tank. When the pressurized water reentered the tank it passed through a jet-mixing unit to agitate the water remaining in the tank.
3. The borate was dumped into the tank. The agitating action caused by the jet-mixing unit mixed the water and borate together.

* * * * * * *

4. After mixing, valve control continues to send a portion of mixed chemical into the tank to continue the jet-mixing, while the balance of mixed chemical is pumped into the airplane.

D. Aircraft ground handling

1. The Ag–2 returned from the previous drop with the four wing tank dump valves open.
2. The airplane entered the loading area and had dump valve doors and adjacent mechanism water flushed to remove the rapidly drying coat of water-borate residue to prevent malfunctioning of gate mechanism.
3. Following the cleaning, the dump valve doors were relatched and the wing tank filler caps opened for loading.
4. Approximately 161 gallons of mix were pumped into the airplane's four wing tanks to make a total payload of about 1,663 pounds. (See par. II–B above.)
5. The washing and loading operation from touchdown to takeoff required about 5 minutes. The airplane engine ran continuously except when refueling was required.
6. After the airplane took off, the loading area was flushed clean.

IV. FLIGHT OPERATIONS

A. During the period of December 26–29, the Ag–2 made 31 flights to the fire areas from Santa Monica Municipal Airport carrying a total of 51,460 pounds of chemical mix.

Date	Number of drops	Total elapsed flying time	Fire areas
Dec. 26	2	1 hour 50 minutes	Hume (Malibu) mostly concentrated in Corral Canyon.
Dec. 27	9	5 hours 5 minutes	Same as Dec. 26.
Dec. 28	10	5 hours 30 minutes	Hume (Malibu), Lake Sherwood and Los Flores Canyon.
Dec. 29	10	3 hours 25 minutes	Los Flores Canyon.
Total	31	15 hours 50 minutes	

B. The majority of aerial drops were made into canyons covering areas in the path of the fire. The drops were made flying downhill into the canyon at 80 to 90 miles per hour, 20° flap and at altitudes varying from 6 to 20 feet.

The swath widths were about 35 to 40 feet wide and up to one-half mile in length. The complete flight from the airport to the fire areas, maneuvering, and return averaged 50 miles, 20 to 30 minutes trip time with ferry speed at 110 miles per hour indicated.

C. Excellent cooperation was given to the Transland aerial operation by the control tower crew at Santa Monica Municipal Airport. The Ag–2 was permitted to use a special approach and takeoff flight pattern, contrary to normal traffic to reduce flight time. The Ag–2 was also given special priority in landing and takeoffs.

V. CONCLUSIONS

A. Except for the normal flight test program the Ag–2 is presently undergoing, this 4-day aerial fire-fighting operation was the first severe service test for the airplane. Pilot Masterson reported afterward, that the visibility from the cockpit was excellent, the airplane operated with ample reserve engine power to easily meet any sudden maneuver, and that the airplane was very easy to control. Each evening the airplane returned to the Transland factory for thorough inspection for engineering evaluation and to service it for the next day's operation.

B. Because the Ag–2 is still engaged in certain phases of the CAA flight test program, only the four wing tanks and their respective dump valves (designed to meet normal and agricultural spray system requirements) were used for the chemical drops. At the time of the fire outbreak when the emergency need for the Ag–2 occurred, time did not permit the modifications necessary to insure rapid jettisoning of the water borate for maximum concentration and effectiveness.

During the first day the Ag–2 made two experimental aerial drops with water only, since the borate chemicals and mixing equipment were not available. From the second day on, the Los Angeles County Fire Department furnished the chemicals, mixing crew, and mixing equipment.

The second day of aerial drops indicated that the dumps were too long in duration to achieve adequate concentration of borate to stop the approaching fire. On the second night the airplane was modified by providing enlarged vent lines to each tank.

The third and fourth day drops indicated that the vent modification proved sufficient to obtain drops with adequate concentration of borate to the ground to retard the fire.

C. If time had permitted, the Ag–2's fuselage hopper gate could have been modified to apply 60 gallons per second at 80 mile per hour to achieve maximum effectiveness of borate on the ground, a still further modification would divide the hopper into two sections, each with a large dump gate, to permit the pilot to choose a single 2,200 pound dump, or two 1,100 pound dumps, as the fire condition might require.

D. Pilot Masterson stated that the principal hazard connected with this fire operation was the close proximity to him of unauthorized sightseeing aircraft. He also experienced close passes by two jet fighters.

VI. THE AG–2 AS FIRE PREVENTION EQUIPMENT

A. Transland Co. believes that the evaluation of aerial equipment for forestry or fire prevention work should be based on the equipment's capability to do a wide variety of jobs as well as fire fighting.

In the development of the Ag–2 configuration, design factors considered were size, payload, maneuverability and optimum economy. These factors make the Ag–2 a highly versatile piece of aerial equipment to accomplish the following jobs on a year-round operating basis:

1. Fire control.—because of its wing multitank arrangement the pilot has a choice of aerial dumps to be jettisoned individually (62.5 gallons) or together (250 gallons). The Ag–2's 53-cubic-foot capacity hopper in the fuselage can be used for chemical drops. It is located forward of the pilot and, under favorable conditions, can hold over 300 gallons of water.

2. Fire patrol.—again, because of its multitank and hopper arrangement the Ag–2 can carry an adequate supply of fuel, water and chemicals for reconnaissance and blaze spotting and to combat the fire before it spreads. The pilot has exceptionally good visibility from the cockpit. The airplane is capable of cruising up to seven hours on patrol work without refueling.

3. Supply drops.—Aerial drops can be made to ground personnel in isolated fire-fighting areas or to supplement regular pack hauls to remote or inaccessible areas. The Ag–2 can carry up to 300 pounds of supplies in each of eight special drop tanks hung under the wing and attached with standard bomb shackles. the fuselage hopper can also be used for drops.

4. Reseeding of damaged watershed areas.—The Ag–2 dust-seed equipment is capable of the following flow rates, based on operational speeds and a 45-foot swath width: 10 to 400 pounds of dust, seed, or pellet per acre.

The Ag–2 can carry 35 bushels of rye seed in its 53-cubic-foot hopper or enough seed to sow 166 acres at 12 pounds per acre flow rate. The hopper is located between the firewall and cockpit, an important safety feature from the pilot's viewpoint. The Ag–2's full span flaps create a good downdraft for dispersal of seeds and pellets.

5. Forest fertilization and insect control.—Is easily accomplished by the Ag–2 using its standard agricultural dust dispensing and liquid-spray applicating equipment. The Ag–2 meets United States Government aircraft requirements for forestry contract work.

6. Firebreaks.—Through the application of herbicides such as 2, 4–D and 2, 45T, the Ag–2 can maintain existing fire breaks easily, rapidly and economically, especially in inaccessible areas.

VII. OTHER AERIAL FIRE FIGHTING ACTIVITIES

A. Research history

Aircraft have participated in varying degrees in forest fire fighting since 1919. At first use was limited to detection of small fires and to aerial reconnaissance of large fires.

During the thirties the United States Forest Service experimented with spraying or bombing fires with water and other extinguishers. These tests showed some promise but the lack of adequate aircraft and suitable facilities concluded these efforts. Out of these tests and later ones, however, came the "smoke jumpers," the delivery of men and equipmnt to fires in roadless country. Also developed were improved methods of detecting fires, and the substitution or supplementing of fixed lookout systems by regular air patrol.

In the late forties, renewed efforts were made by the United States Forest Service and the Air Force in the techniques of bombing of forest fires. On small fires good results came by dropping large water bombs at treetop height by B–29's and from modified tip tanks on P–47's, the latter using skip or dive bombing techniques. During these periods of time study was made by Canadian Foresters in waterbag drop techniques which met with considerable success. Other known studies have been conducted in Australia.

In 1953 disastrous fires in southern California resulted in an extensive investigation in 1954–55 known as Operation Firestop. Agencies working on this cooperative program included the California Division of Forestry, United States Forest Service, Los Angeles County Fire Department, Los Angeles City Fire Department, California Office of Civilian Defense, Federal Civil Defense Administration and Department of Defense. This study was conducted and coordinated through the University of California School of Forestry.

Operation Firestop was an operational study designed to explore certain aspects of mass fire buildup and behavior, and to provide the fire services with some new aids to mass fire prevention and control. Actual demonstrations of chemical applications by air were conducted. The tactical possibilities of heli-

copters were explored, and methods were developed to transport men and fire pumps with water to fire in rugged terrain.

During 1956 more studies were made at Willows, Calif., by fire agencies working with agricultural crop-dusting operators to refine aerial tactics.

It is understood by Transland Co., that a report undertaking a complete evaluation of the 1956 research studies and actual fires involving aerial applications of water and chemicals will be forthcoming shortly from the United States Forest Service Fire Research Staff at the University of California at Berkeley.

B. Aerial tanker use on fires

In 1955, field trials, calibration tests, and actual waterdrops were made on actual wildfires at Mendocino National Forest in California. These waterdrops proved effective in quieting hot spots on large fires and in retarding spread of small fires in brush and grass. Complete details were described in Forest Research Notes, No. 99, dated October 20, 1955.

During 1956 extensive aerial water and chemical drops were made in northern and southern California on national and State forest areas. Between August 12, 1956, and September 30, 1956, a total of 23 fires were combated by aerial tankers which dropped 83,120 gallons of water and 40,580 gallons of chemical retardant. Aerial drops were a real help on 14 fires, good help on 4, no help on 4, and adverse on 1 fire (the latter put out a backfire and made control more difficult). These fires are listed in summary of use, Aerial Tankers, 1956 and described in Aerial Tankers * * * a new tool for forest fire fighting, both issued by United States Forest Service, San Francisco. Among these 23 fires is the McKinley fire which burned 10,000 acres in San Bernardino County. During this fire 24,480 gallons of water and 25,400 gallons of chemical retardant were dropped. These aerial drops were considered a "real help" by the forestry services.

These aerial drops were made by agricultural aircraft operators from the Willows-Red Bluff area in northern California.

During December of 1956 three major fires occurred in which aerial chemical drops were made. One was in San Diego County which burned 44,000 acres and the second was in San Bernardino County mountains which blackened 15,000 acres. Details of these aerial drops are not known by Transland Co. The third fire burning 40,000 acres in Los Angeles County is described in this Transland report T2–13.

VIII. OTHER TRANSLAND DATA

A. Motion picture

The Transland film The Ag–2 and the Santa Monica Mountain Fire describes the Ag–2, shows ground operations at the Santa Monica Municipal Airport, aerial chemical drops over the fire area, and general scenes of the fire. This film footage was obtained from TV news bureaus, Los Angeles County Fire Department, and other sources.

This 16-millimeter film runs about 11 minutes, is silent with explanatory titles and appears in black and white, and color. The film and copies of this report are available, contact: Transland Co., advertising department, 2600 West 247th Street, Torrance, Calif. Phone: DAvenport 6–1681.

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ADDENDUM

Reference: Section II The Ag–2 Airplane.

Following its participation in the Santa Monica Mountains fire, the Ag–2 has undergone two major changes. One is the installation of a unique hydraulically operated dust-spray system and the second is the change from the 450-horsepower engine to a 600-horsepower engine.

For dusting or the dumping of fire retardant chemicals, 2,000 pounds of dry chemicals, seed, or water-borate can be carried in the large 53-cubic-foot hopper in the fuselage. The hopper's loading lid opening is 480 square inches. At the base of the hopper are two 198 square inch openings controlled by a rotary gate. The gate is hydraulically operated for instant action gate opening and closing, and allows the pilot to make in-flight adjustment of the gate opening from 0 to 396 square inches. The rotary gate is patterned after Transland Co.'s highly successful hopper rotary gate for Stearman airplanes.

The liquid system, with its four 62.5-gallon wing tanks, features a hydraulically driven, high density, Pickell pump. The pilot has instant start-stop control and can make in-flight adjustment for high or low gallonage flow rates. The centrifugal pump is mounted aft of the rotary gate and inside a fairing, outside the fuselage to avoid damage to the airframe from possible leakage of corrosive chemicals.

* * * * * * * *

(COMMITTEE NOTE.—The following letter was subsequently submitted in response to a request for information made by the chairman (see p. 164):)

CALIFORNIA FOREST PROTECTIVE ASSOCIATION,
San Francisco, Calif., October 16, 1957.

HON. CLAIR ENGLE,
Representative, Second Congressional District of California,
House Office Building, Washington, D. C.

DEAR CONGRESSMAN: On October 9, 1957, I presented a statement to your subcommittee which is studying fire-protection problems in California.

On page 3 of the prepared statement, I made the following statement: "There is a difference in the policies of brush fire fighting methods as conducted by the State division of forestry and the United States Forest Service. The Forest Service have certain practices of attack from a fire line which the State policy absolutely prohibits because of danger to its crews." My choice of words in expressing this was perhaps not too good as the inference was that the practices used by the Forest Service were contained in the Forest Service fire-fighting policies or regulations. The Forest Service policy in fire technique may be right but the attack approach used in many instances have been wrong. You asked me, however, if I would document my statement.

The manner of fire attack by the United States Forest Service which is contrary to the manner in which the State division of forestry attacks such brush fires was brought to my attention by men who were engaged in the fire-control supervision on the big brush fires in southern California in the last few years.

As you recognized at the hearing, this is a matter of considerable importance. It does need careful investigation by someone skilled in fire-control technique. I would not want to be a party to a vindictive attack on either organization or the personnel, over resulting past casualties. This matter would be best handled nonpolitically and without publicity, as it would be doubtful if either agency would lay bare its practices or differences if there was fear of blame for lives lost. It is true, however, that key men, at a high level in fire control, blame some of the loss of life on failure to follow certain basic rules of fire-control technique. No one with proper knowledge would ever take men into a fire on a slope with the fire burning up the slope and underneath the area in which the men were attempting to stop the fire. It is always a basic rule that such fires are controlled (or the attempt to control is made) at the top of a slope with the use of fireproofed fire lines and the setting of a back fire to burn down to meet the upcoming fire. Another method is to approach a fire from the burned area and work toward the sides to burn the fire in.

Although I have not actually seen the report, I understand that an investigation by the fire experts of the California Forest and Range Experiment Station was made of the fire in southern California which brought about the loss of lives of fire fighters. I understand the report states that these men were warned that they were above the fire. With such knowledge and an intimate familiarity with the terrain and climatic conditions then existing, the warning should have been, for the men to come out of the area. This indicates that the supervision of the fire fighters was in inexperienced hands in that area rather than they remained because of a rule to pursue such a method of attack.

In my opinion, it would hurt the cause by forcing the United States Forest Service and the State division of forestry into a dogfight over fire-fighting techniques. I do, however, believe that through your efforts might come the instigation of a study and examination of fire control techniques on wildland fires, from a safety standpoint. This study should be made in cooperation with the most experienced fire technicans in the two organizations. There should be no intent to criticize past actions from a disciplinary standpoint but rather to prepare improved guides and rules for the future for both organizations.

The need for safety rules or guides is very important when one considers that the United States Forest Service brings in supervisory and other personnel from outside the area and sometimes from out of the State, who are unfamiliar with the terrain, the ground cover and the weather conditions. As often happens, such men unfamiliar with the area are in control at nighttime when unusual conditions arise which are extremely hazardous.

I believe that a sincere constructive approach to this problem, which is not dominated by the United States Forest Service or the State division of forestry, can save the loss of lives in the future.

Criticism of past actions at this time might do irreparable damage to the organizations and to the individuals, which would tend to reduce their effectiveness and could not restore the lives lost.

California Forest Protective Association would be glad to cooperate and to work with you and any other committee or agency in a careful analysis of this subject matter.

With kindest personal regards.

Very sincerely,

W. R. SCHOFIELD, *Secretary-Manager.*

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